INSTRUCTION SUPPLEMENT

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WJ—8716 HF RECEIVER

Development

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INTRODUCTION

The WJ-8716 HF Receiver is a modified version of the WJ-8718 HF Receiver. An outline of the electrical and mechanical changes as well as the parts list and schematics are contained in Section VII at the back of this manual. All other material covered in the WJ-8718 instruction manual pertains to both receivers.

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20760

TER 6/78

October 10, 1978

ADDENDUM I

This addendum contains the procedures for field modification of the 2nd LO Synthesizer, Type 791601 (A5A2). Occasional frequency instability has occured in the 2nd LO Synthesizer due to temperature variation and mechanical vibration. IF YOU HAVE ENCOUNTERED OR SUSPECT THIS PROBLEM WITH THE 2ND LO, USE THE PROCEDURES BELOW. If the parts required for the modification cannot be readily obtained, contact Watkins-Johnson, Gaithersburg, Maryland, or your nearest Watkins-Johnson representative.

PARTS REQUIRED

Capacitor, Ceramic, Tubular: .01 μF, 20%, 50 V
Capacitor, Ceramic, Tubular: 27 pF, 5%, 500 V, NPO
2 Extender Cards: Type 791647, available from Watkins-Johnson

MODIFICATION PROCEDURE

1. Remove the 2nd LO Synthesizer (A5A2) and disconnect the 2nd LO Shield from the back of the circuit board by removing the six nuts and washers.
2. Remove the RFI Shield (can) covering the 32 MHz VCO circuitry by removing the two nuts and washers.
3. Refer to Figure 5-26 (page 5-64) of the Instruction Manual and change C49 from 12 pF to .01 μF and C50 from 47 pF to 27 pF.
4. Reinstall the RFI Shield using the hardware removed in Step 2 and reinstall the 2nd LO Shield using the hardware removed in Step 1.

ALIGNMENT PROCEDURE

1. Allow a digital voltmeter (DVM) a warm-up period of 30 minutes.
2. Connect the 2nd LO Synthesizer (A5A2) to two extender cards and insert into its connectors in the receiver.
3. Energize receiver and tune to 15.00499 MHz.
4. Connect the DVM to test point E1, or module pin B57 on Type 791570 Synthesizer Motherboard (A5), and adjust C51 for a 3.0 Vdc reading.
5. Connect the DVM to test point E3, or module pin A51 on Type 791570 Synthesizer Motherboard (A5), and adjust L8 for a 4.0 Vdc reading.
6. Connect the DVM to test point E2, or module pin A55 on Type 791570 Synthesizer Motherboard (A5), and adjust C61 for a 3.0 Vdc reading.
7. Connect the DVM to test point E1 and insure that C51 is adjusted for a 3.0 Vdc reading.

PERFORMANCE TEST

1. Allow a frequency counter a warm-up period of 30 minutes.
2. Connect the frequency counter to the 2nd LO output that is connected to A2J1 of Type 791592 Input Converter (A3).
3. Tune the receiver to 15.00000 MHz and verify a reading of 32.21000 MHz.
4. Tune the receiver to 15.00500 MHz and verify a reading of 32.20500 MHz.
5. Tune the receiver to 15.00999 MHz and verify a reading of 32.20001 MHz.

INSTRUCTION MANUAL
FOR
WJ–8718 HF RECEIVER

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20760

Engineers: Charles E. Dexter
William S. Massey
Writer: Gary W. Brohawn

Revision I 7-5-78

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

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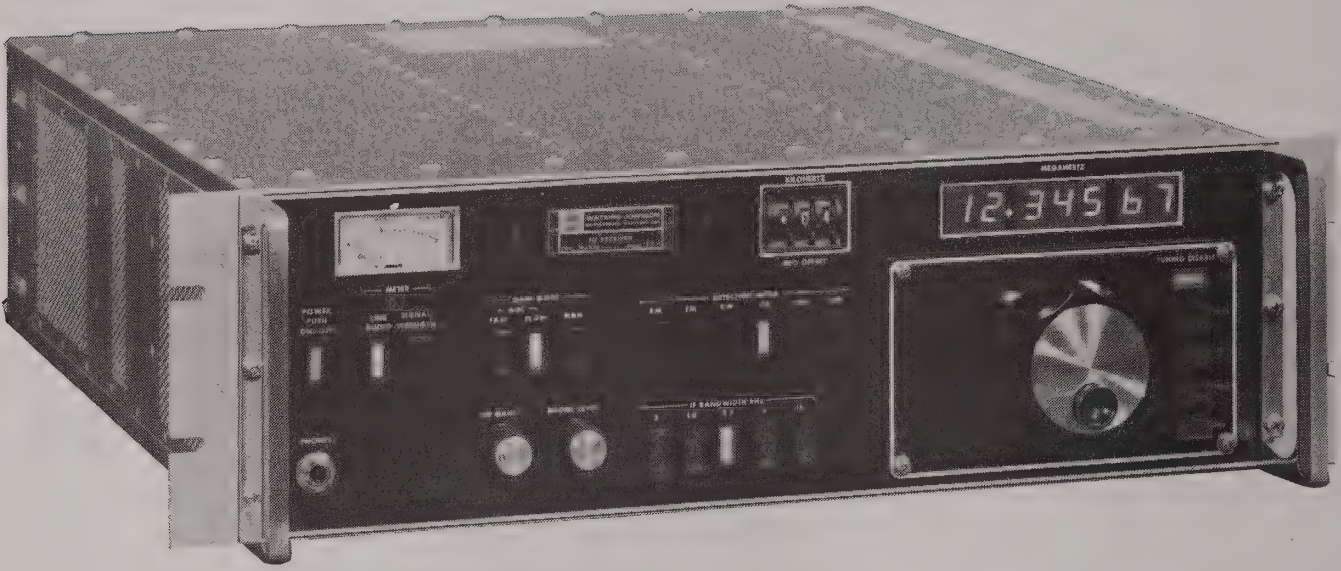

MEGAHERTZ
12.345 67
KILOHERTZ
METER
POWER PUSH ON/OFF
IF BANDWIDTH KHz

Figure 1-1. WJ-8718 HF Receiver

SECTION I
GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

The WJ-8718 HF Receiver is designed to receive AM, FM, CW, USB, LSB, and ISB emissions over the frequency range of 5 kHz to 29.99999 MHz. The receiver provides manual control, with remote control and remote monitoring being optional. In the manual mode, operating parameters are selected by pressing appropriate pushbutton/indicators. The depressed button indicates the selection of the operator by the appearance of a brightly colored display behind the clear front surface. Seven digits composed of light emitting diodes (LED's) indicate the tuned frequency to a resolution of 10 Hz. The large tuning knob and four tuning rate pushbuttons provide frequency tuning capability. A tuning disable pushbutton locks the receiver to a specific frequency, thereby preventing accidental operator frequency changes. The optional remote control mode is enabled by one of two methods: depressing the TUNING DISABLE pushbutton, or a control change activated by the remote device. A jumper wire on the manual tuning up/down counter card determines the method employed. In the remote mode, the receiver will respond to parallel input data, consisting of frequency and bandwidth information, and is compatible with buffered CMOS levels.

Pushbutton-selectable parameters in addition to the operating modes are IF Bandwidths, Gain Mode, and Meter Select. Selectable IF bandwidths of 0.3 kHz, 1.0 kHz, 3.2 kHz, 6 kHz, and 16 kHz operate in conjunction with the AM, FM, or CW detection modes. When the optional ISB, LSB, or USB detection modes are chosen, IF bandwidth selection is ineffective due to the automatic override by the detection mode control. RF Gain may be controlled manually or by Fast or Slow AGC. A dual-purpose meter indicates Signal Strength or Line Audio Level.

Internal frequency tuning circuitry of the basic receiver includes the 1st, 2nd, and 3rd LO Synthesizers, and a BFO Synthesizer. The phase lock loop frequency synthesizers determine tuned frequency to a resolution of 10 Hz. The synthesized BFO tunes ± 8.9 kHz from 455 kHz in 100 Hz and 1 kHz steps. A non-volatile memory stores the tuned frequency for a minimum of 48 hours after power interruption (i.e., power failure or manually turning power off).

Rear panel features include BNC connectors for a 50 Ω RF input, a 455 kHz IF output, and a 1 MHz reference input/output selectable by a related slide switch. Two five-lug terminal boards provide audio outputs that include: a 600 Ω floating center-tapped ISB output (for the lower sideband), a single-ended Phone Output, a center-tapped Line Audio Output, and an FM/CW/SSB detector output for monitoring. Line voltage selection for high and low voltage conditions may be accomplished in a few seconds by inserting the printed circuit (pc) wafer in one of four positions in the line cord assembly.

Maintenance operations are straightforward due to the clean mechanical packaging and the placement of nearly all components on plug-in circuit boards. These circuit boards mount on motherboards having all pins accessible from the bottom of the receiver. Adjustments and alignments have been kept to a minimum. Removing the top cover exposes the assemblies, all of which may be unplugged from their sockets or freed from the main chassis by quick disconnect plugs. The dc power supplies are thermal and short circuit protected, require no adjustments, and can easily be replaced. A printed circuit wafer, accessable on the rear panel, makes possible the matching of the power transformer to line voltages of 110 Vac (± 15%) and 220 Vac (±15%).

1.2 MECHANICAL CHARACTERISTICS

The receiver mounts in a standard 19-inch equipment rack, occupies 5.25 inches of vertical space, and extends 19.6 inches into the rack. The main chassis, front, rear, top, bottom, and internal compartment panels are constructed of aluminum. All operating controls and indicators are on the front panel, while all input and output cables are connected to the rear panel (except for the phone jack). This package meets the radiation specification of MIL-STD-461A.

The front panel is overlaid with a black bezel etched with control markings. All of the pushbuttons are mounted on a printed circuit card positioned behind the front panel, and extend through cutouts in the front panel. All of the remaining controls and line audio/signal strength meter are mounted directly on the front panel. The tuned frequency numeric display is mounted on a card positioned behind a cutout in the front panel, over which a polarized filter is installed. The audio phone jack, RF gain control, and phone level control are also mounted on the front panel.

The rear panel mounts all input, output, and accessories, with the exception of the above mentioned phone jack. BNC connectors are supplied for the RF input, IF output, and 1 MHz reference input/output. The INT/EXT clock switch for selecting internal or external timebase reference is located next to the 1 MHz reference input/output. Two terminal blocks supply an output for Line Audio, Phone Audio, ISB Audio, and FM Audio. Two fuseholders are found on the rear panel. The circular fuseholder is used to hold the alternate line voltage fuse, while the retangular fuseholder has the additional functions of line filter, voltage selection, and AC line cord receptacle. Also on the rear panel are +15 V, -15 V, and +5 V heat sinked regulators, a Line Audio potentiometer and optional 37-pin female connectors for remote control.

Loosening 34 quarter-turn fasteners allows the top cover to be lifted from the receiver thus exposing four main compartments. A power distribution circuit, input converter, and optional preselector mount in one compartment and three synthesizer boards mount in another. The IF modules and the digital control circuits are also in separate compartments for mechanical support and shielding purposes.

Removing the bottom cover, also held in place by 34 quarter-turn fasteners, exposes three motherboards that mount a total of 27 modules and the components mounted on the front panel. All connections to the motherboards are made with push-on plugs so that replacement of a motherboard consists of removing less than 10 screws and the plugs.

Side panels are cast aluminum, the front panel 0.19-inch aluminum plate, and the rear panel, main deck, and internal partitions stamped aluminum. The side panels and top and bottom covers are perforated to allow for flow-through ventilation.

1.3 EQUIPMENT SUPPLIED

The equipment supplied consists of the receiver and a detachable line cord.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Select equipment from the following general classifications to obtain full use of the receiver.

1. Antenna, 50 Ω
2. Audio monitoring equipment such as the following: (for monitoring ISB signals, two units will be required except for headphones, which monitors both sidebands)
   a) speaker panel, 600 Ω
   b) stereo headphones, 600 Ω
   c) tape recorder
3. Wideband tape recorder for 455 kHz IF amplifier predetection output
4. IF-to-tape converter, 455 kHz to video
5. Remote Input Interface -- for receivers utilizing remote control operation. Refer to the Installation Section of this manual for definitions of the input lines.
6. Two extender cards are required (available from Watkins-Johnson) for troubleshooting to the component level.

1.5 OPTIONAL EQUIPMENT

The following optional equipment is available for use with the WJ-8718 HF Receiver. For additional information concerning these options and others, contact Watkins-Johnson Company, Gaithersburg, Maryland, or your Watkins-Johnson representative.

1.	Manual Control Module	WJ-8718/MCM*
2.	Remote/Manual Control Module	WJ-8718/MCM-2*
3.	Independent Sideband (ISB) Module	WJ-8718/ISB
4.	Sub-Octave Preselector	WJ-8718/PRE
5.	IEEE-488 Interface Bus	WJ-8718/488-1
6.	10 Hz BFO Synthesizer	WJ-8718/B10
7.	Signal Monitor Output	WJ-8718/SMO
8.	Teletype Output	WJ-8718/TTY
9.	Indicating Front Panel	WJ-8718/IFP
10.	Red LED Frequency Display	WJ-8718/RED
11.	Yellow LED Frequency Display	WJ-8718/YEL

* Note: Either MCM or MCM-2 is required with mainframe for receiver operation.

Table 1-1. Type WJ-8718 HF Receiver, Specifications

Tuning Range	5 kHz to 29.99999 MHz
Tuning Resolution	10 Hz
Antenna Conducted Oscillator Radiation	-87 dBm, maximum
Antenna Input Protection	The antenna input will withstand the effects of RF power to +15 dBm and static build-up. The protection circuit automatically resets.
Input Impedance	50 ohms, unbalanced, nominal
IF Bandwidths (3 dB)	Standard: 0.3, 1, 3.2, 6 and 16 kHz
IF Shape Factor	IF BW 60 dB: 3 dB, Typical 0.3 kHz 7.0:1 1 kHz 4.5:1 3.2 kHz 2.5:1 6 kHz 2.3:1 16 kHz 2.0:1
Detection Modes	Standard: AM, FM, CW Optional: LSB, USB, ISB
Gain Control Modes	Manual, Fast AGC, Slow AGC
AGC and Manual Range	100 dB, minimum
AGC Threshold	3.0 microvolts, typical
AGC Attack Time	15 ms, maximum
AGC Release Time	Fast AGC: 25 ms, maximum Slow AGC: 4 sec, maximum
Frequency Display	7 digit LED's
Frequency Resolution/Readout	10 Hz
Frequency Stability	6×10^{-8} per day, 2×10^{-6} per year
Frequency Control	Manual or Remote options
Synthesizer Lock-Up Time	3 ms, typical; 10 ms, maximum
Synthesized BFO	455 kHz ±8.9 kHz in 100 Hz steps
Power Interrupt	With the Manual Control Module option, storage of the frequency data will automatically occur. Upon restoration of power, the receiver will return to the previously tuned frequency.
IF Rejection	Greater than 90 dB
Image Rejection	Greater than 90 dB
Sensitivity (0.2-30 MHz, see CW Sensitivity for extended frequency range)	
AM Sensitivity (6 kHz IF Bandwidth)	A 1.7 microvolt signal 50% AM modulated at a 400 Hz rate will produce at least a 10 dB (S+N)/N ratio at the audio output.

Table 1-1. Type WJ-8718 HF Receiver, Specifications (Continued)

FM Sensitivity (16 kHz IF Bandwidth)	A 2.5 microvolt signal FM modulated at a 400 Hz rate to a 4.8 kHz peak deviation will produce at least a 17 dB (S+N)/N ratio at the audio output.
CW Sensitivity (0.3 kHz IF Bandwidth)	
200 kHz-30 MHz	A 0.4 microvolt signal will produce a 16 dB (S+N)/N ratio at the audio output.
50 kHz-200 kHz	A 0.63 microvolt signal will produce a 16 dB (S+N)/N ratio at the audio output.
15 kHz-50 kHz	A 1.4 microvolt signal will produce a 16 dB (S+N)/N ratio at the audio output.
5 kHz-15 kHz	A 63 microvolt signal will produce a 16 dB (S+N)/N ratio, typically at the audio output.
ISB, (USB, LSB) Sensitivity (3 kHz SSB Bandwidth)	A 0.56 microvolt signal will produce a 16 dB (S+N)/N ratio at the audio output.
Audio Outputs:	
ISB Output	100 milliwatts, minimum across 600 ohms
Line Audio	2 watts, minimum, across 600 ohms for an input signal of 3 microvolts, 30% AM modulated at a 400 Hz ratio
Headphone Output	300 milliwatts, minimum, for an input signal of 3 microvolts, 30% AM modulated at a 400 Hz rate
Audio Distortion	Less than 5% at rated audio output
Audio Frequency Response	±1.5 dB from 100 Hz to 8 kHz, 1 kHz reference frequency
Final IF Output	20 millivolts, minimum, into 50 ohms for input signals greater than 3.0 microvolts
Intermodulation Distortion:	
3rd Order Input Intercept Point	+20 dBm, minimum for signals separated by 30 kHz, minimum
Unwanted Sideband Rejection	50 dB at 350 Hz into unwanted sideband
Signal Meter	Indicates carrier level or line audio level
Reciprocal Mixing	With a desired signal of 25 microvolts, in the 3.2 kHz IF bandwidth, the desired signal to noise ratio will be greater than 20 dB, when an undesired signal 70 dB higher in amplitude and removed 30 kHz in frequency is present.

Table 1-1. Type WJ-8718 HF Receiver, Specifications (Continued)

Cross Modulation	With a desired signal of 10 microvolts, an undesired signal 70 dB higher, 30% AM modulated will produce less than 10% cross modulation for frequency separation of greater than 50 kHz in the 1 kHz IF bandwidth.
Operating Temperature Range *	0° C to 50° C
Power Consumption	Approximately 0.6 amps at 115 Vac
Power Requirements	110/220 Vac ±15% 48-420 Hz
Size	5.25 inches high, 19 inches wide and 19.4 inches deep
Weight	Approximately 35 pounds

* Operation within specifications guaranteed at 25°C ± 5°C

Note: A stereo headset will provide 30 milliwatts for each sideband in the ISB mode; USB output available on the stereo phone "tip", LSB output available on stereo phone "ring".

SECTION II
INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before the WJ-8718 is unpacked. If the carton has been damaged, try to have the carrier's agent present when the equipment is unpacked. If not, retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, Gaithersburg, or your Watkins-Johnson representative with details of any shortage.

The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is, therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. If external damage is visible, remove the dust covers and inspect the internal components for apparent damage. Then check the internal cables for loose connections, and plug-in items such as printed wiring boards, which may have been loosened from their receptacles.

2.2 PREPARATION FOR RESHIPMENT AND STORAGE

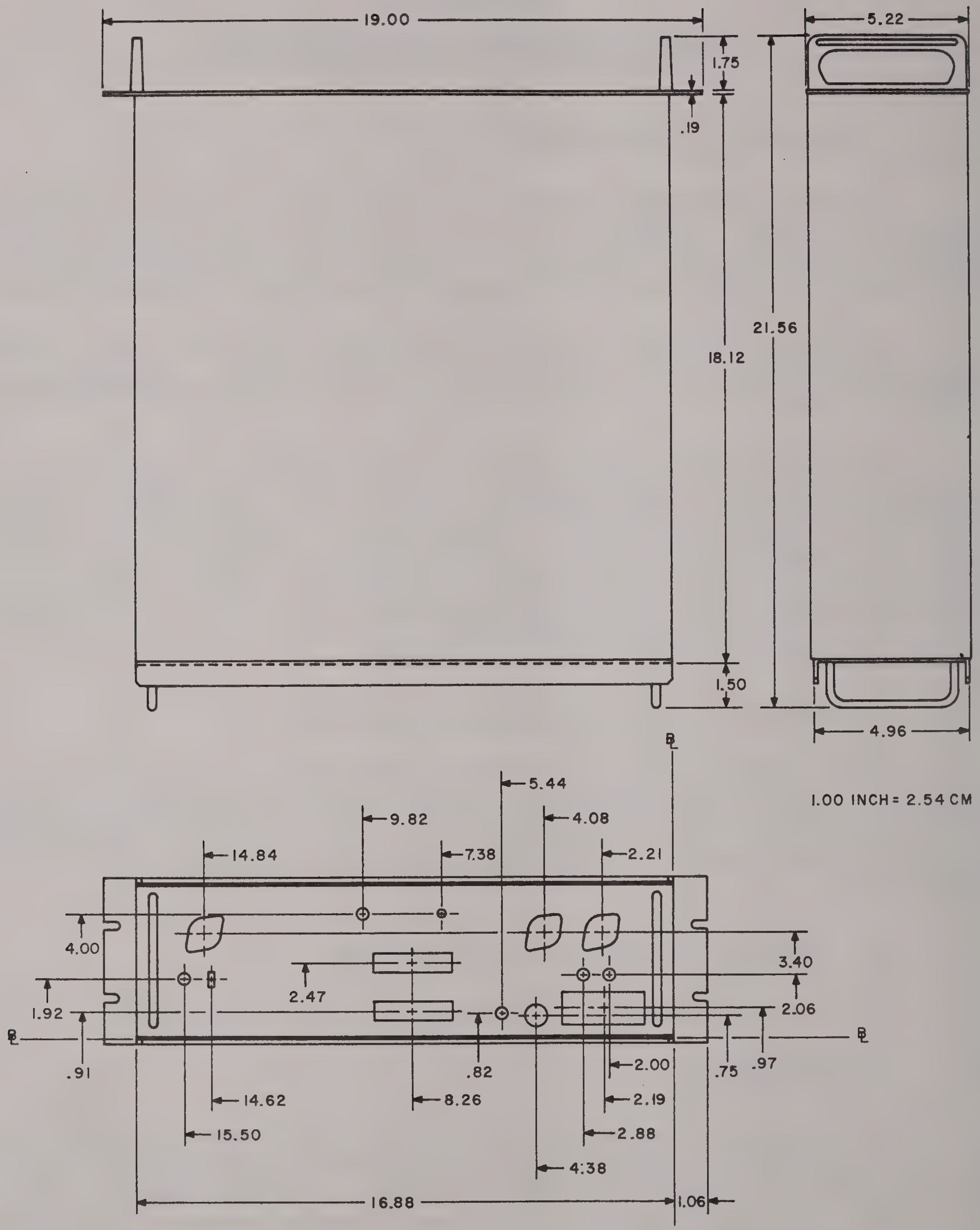
If the WJ-8718 must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be used to a large extent or will at a minimum provide guidance for the repackaging effort. Conditions during storage and shipment should normally be limited as follows:

1. Maximum humidity: 95% (no condensation)

2. Temperature range: -30° C to 85° C

2.3 INSTALLATION

The receiver is designed for mounting in a standard 19-inch equipment rack. It occupies 5.25 inches of vertical rack space and extends approximately 19.62 inches into the rack to the tips of the rear protective handles. Critical dimensions are shown in Figure 2-1. Do not rely solely on front panel mounting hardware to support the receiver. A brace extending along the sides from the front panel to the rear panel is preferred. The rack should allow a free flow of air through top and bottom covers and side panels, as well as around the outer surfaces of the receiver.


19.00
1.75
.19
18.12
21.56
1.50
5.22
4.96
℄
5.44
9.82
4.08
14.84
7.38
2.21
4.00
3.40
2.47
1.92
2.06
℄
℄
.91
.82
.75
.97
2.00
14.62
8.26
2.19
15.50
2.88
4.38
16.88
1.06

1.00 INCH = 2.54 CM

Figure 2-1. WJ-8718 Receiver, Critical Dimensions

Access to the rear panel should be allowed so that input and output connections can be conveniently made or changed if desired. Figures 5-1 and 5-2 are photographs of the front and rear panels showing the locations of the connectors. Described below are the functions and input/output parameters of each connector.

2.3.1 LINE CORD RECEPTACLE AND VOLTAGE SELECTOR FUSE BLOCK (FL1J1)

This multifunctioned assembly should always be inspected before installation of the receiver in a new location. With the line cord unplugged, the clear plastic window can be slid over the three male power receptacle prongs. This exposes the line fuse and a hinged, plastic FUSE PULL lever.

Swinging of the FUSE PULL lever to the left ejects the fuse from the holder and frees a line-voltage-select pc wafer found at the bottom of the assembly. Looking down on the pc wafer at a slight angle on the left side shows the selected line voltage for the receiver, either 100, 120, 220, or 240 Vac. If the voltage shown does not match the available line voltage, remove the pc wafer and reinstall it so that the closest line voltage is visible with the pc wafer in position; the pc wafer should be set in the voltage position closest to the line voltage being used. Then install the fuse suitable for the line voltage: 1 amp slow-blow for 100 Vac and 120 Vac, or 1/2 amp for 220 Vac and 240 Vac. Install the other fuse in the alternate fuse holder.

Slide the clear plastic window back over the fuse and pc wafer portion of the assembly holder and insert the line cord in the receptacle.

2.3.2 RF INPUT (A2J1)

This BNC connector is the RF signal input for the receiver. Nominal input impedance is 50 Ω. The input is protected against signals exceeding +15 dBm (1.25 Vrms) and static build-up.

2.3.3 ALTERNATE FUSE HOLDER (F2)

This fuse holder provides convenient storage of the fuse for the line voltage not in use. There is no electrical connection to the fuse holder.

2.3.4 IF OUTPUT (J12)

This BNC connector supplies a 455 kHz IF output. The level will be 20 mV, minimum, into 50 Ω, for RF input signals greater than 3 μV.

2.3.5 TERMINAL BOARD (TB1)

Two audio outputs are available on this board. They will be described separately.

1. LINE AUDIO. These three terminals provide a floating, 600 Ω, center tapped audio output. This output will drive a 600 Ω load from zero watts to at least two watts (0 V to 34.6 Vrms) depending on the setting of rear panel LINE AUDIO LEVEL potentiometer R1. This line voltage is monitored by the front panel meter when the LINE AUDIO METER Switch is engaged.

2. PHONE AUDIO. This single ended output is in parallel with the front panel PHONES jack and is meant to drive a 600 Ω load. Output level is controlled by the front panel PHONE LEVEL potentiometer and will typically be a maximum of 7.8 Vrms.

2.3.6 TERMINAL BOARD (TB2)

These outputs will be described separately.

1. ISB AUDIO. Three of the terminals on this board provide a floating, center tapped, balanced output for driving a 600 Ω load. Only the LSB signal when in the ISB mode is available from this output. No other signal is available from these terminals. Audio level may be set to a maximum of 100 mW (7.75 Vrms) using a potentiometer on printed circuit card A4A8. The USB signal for the ISB mode appears at the LINE AUDIO terminals of TB1.

2. FM AUDIO. This is a dc-coupled monitor voltage from the discriminator. Measure with a high impedance voltmeter.

2.3.7 LINE AUDIO LEVEL (R1)

This potentiometer adjusts the level of audio signals appearing at the LINE AUDIO terminals of TB1. The front panel meter monitors this output when the related LINE AUDIO switch is engaged. Rotating this control fully clockwise will provide at least a 2 watt audio output (34.6 Vrms/+33 dBm) into 600 Ω.

2.3.8 CLOCK SWITCH (S2)

Setting this switch to the INT position selects the internal time base for the receiver and provides the internal 1 MHz reference output at J11. Setting this switch to the EXT position deactivates the internal reference so that an external signal may be applied to J11.

2.3.9 1 MHz REF (J11)

When the CLOCK switch is in the INT position, this BNC connector provides a 1 MHz, 100 mVrms output into 50 Ω. When the switch is set in the EXT position, a 1 MHz reference signal of at least 50 mVrms into 50 Ω must be applied to J11 to to provide a time base for the receiver.

2.3.10 PHONES JACK (J13)

This output is intended to drive a 600 Ω, or greater, stereo headphone set. When operating in the (optional) ISB mode, both USB and LSB information can be monitored simultaneously through the headphones. Mono headphones, however, may be used with loss of LSB when operating in the ISB mode. In all other modes, both stereo and mono headphones will provide essentially the same results.

2.3.11 REMOTE INPUT OPTION (A6A1J1)

When this 37-pin input connector is provided, remote tuning is enabled by manually pressing the TUNING DISABLE pushbutton, or internally by connecting a jumper wire in the Manual Tuning Up/Down Counter, as described in Note 4 of Figure 6-18. Frequency tuning and IF bandwidth can be remotely selected when in AM, FM or CW modes. Other modes automatically determine IF bandwidth. Identification of the Remote Input Lines is shown in Table 2-1.

2.4 OPERATION

All front panel controls and indicators are described here. The pushbuttons have a mechanical interlock arrangement so that only one button of any group may be in at a time. Partial depression of a button in the out position releases any button previously depressed. A depressed button will be indicated by a brightly colored display behind the clear front surface. If no button has been depressed in any functional grouping, that particular mode will be inactive. For an explanation of front panel features, refer to the following paragraphs.

2.4.1 PUSH ON/OFF POWER (S1)

Press this button in to energize the receiver. During initial installation, be sure the line-voltage-select pc wafer on the rear panel matches the available line voltage before energizing the receiver. Refer to paragraph 2.3.1 for the voltage selection procedure.

2.4.2 METER (M1)

The meter contains two scales of which one is a signal strength scale with a range of 0 to 110 dB. This signal strength scale contains a MAN SET mark on the scale to indicate proper signal strength in the MAN gain mode. The other scale on the meter indicates the audio level of the LINE AUDIO output in dB above 1 mW, referenced to 600 Ω.

2.4.3 METER SWITCHES

The two switches, LINE AUDIO and SIGNAL STRENGTH determine what function the meter will indicate. Both of these functions, are explained below.

1. LINE AUDIO. With this switch engaged, the rear panel LINE AUDIO terminals can be set for 0 to 2 watts output (0 to 34.6 Vrms). Rear panel LINE AUDIO LEVEL potentiometer R1 establishes the level.

2. SIGNAL STRENGTH. This indication is related to the AM detector voltage. In AGC modes it provides a logarithmic indication of signal strength; in the manual gain mode it represents a near linear indication of AM detector voltage.

2.4.4 GAIN MODE

The following switches establish the receiver gain mode.

1. FAST AGC. The 15 ms response time provided in this mode is useful for AM and FM signals.

2. SLOW AGC. The 15 ms attack time and 2 second decay time provided in this mode is suitable for CW, ISB, and SSB signals.

3. MAN GAIN. This mode activates the RF GAIN control which otherwise has no effect. If the AM detector is overloaded while in the MAN gain mode, switching to the SLOW AGC mode may result in a recovery time several times longer than expected for the SLOW AGC mode.

2.4.5 RF GAIN CONTROL

When in the MAN gain mode, rotating the RF GAIN control clockwise approximates a logarithmic increase in receiver gain. With the METER switches in the SIGNAL STRENGTH mode, this control should be set for an indication at the MAN SET mark on the meter.

2.4.6 DETECTION MODE

One of the following six detection switches must be depressed to establish a detection mode. If the AM, FM, or CW switch is selected, an IF BANDWIDTH kHz switch also must be selected. Selection of optional ISB, USB, or LSB switches automatically activates other bandwidth filters related to these modes of operation.

Table 2-1. Remote Input Lines Identification

Remote Control Board A6A1		Remote Input A6A1J1	
E20		Pin- 9	3.2 kHz
E12		Pin- 5	0.3 kHz
E32		Pin-15	1.0 kHz
E24		Pin-11	6.0 kHz
E28		Pin-13	16 kHz
E16		Pin-33	BW enable
E39	2^0	Pin-37	10^1
E29		Pin-32	
E30		Pin-14	
E38	2^3	Pin-18	
E37	2^0	Pin-36	10^2
E34		Pin-16	
E33		Pin-34	
E35	2^3	Pin-35	
E26	2^0	Pin-12	10^3
E13		Pin-24	
E14		Pin- 6	
E25	2^3	Pin-30	
E22	2^0	Pin-10	10^4
E18		Pin- 8	
E17		Pin-26	
E21	2^3	Pin-28	
E10	2^0	Pin- 4	10^5
E08		Pin- 3	
E04		Pin- 1	
E09	2^3	Pin-22	
E06	2^0	Pin- 2	10^6
E11		Pin-23	
E15		Pin-25	
E5	2^3	Pin-20	
E36	2^3	Pin-17	10^7
E40	2^1	Pin-19	
E7		Pin-21	Load
E19		Pin-27	
E23		Pin-29	Ground lines
E27		Pin-31	

1. AM MODE. The LINE AUDIO, PHONE AUDIO, and front panel PHONES audio are taken from the AM detector in this mode.

2. FM MODE. The LINE AUDIO, PHONE AUDIO, and front panel PHONES audio are taken from the FM detector in this mode. A dc-coupled monitor voltage from the detector appears at the FM AUDIO terminals of TB2 for test purposes.

3. CW MODE. Selection of this mode enables the BFO and the BFO offset switch. The LINE AUDIO, PHONE AUDIO, and front panel PHONES audio are taken from the CW/SSB product detector in this mode.

4. USB MODE (Option). Selection of this mode overrides the front panel IF bandwidth switches and activates the independent IF filter for upper sideband reception. Audio will be available at the front panel PHONES jack, and at the AUDIO LINE terminals and PHONE AUDIO terminals of TB1 on the rear panel. The BFO is enabled but fixed in frequency at 455 kHz. The Frequency readout indicates the corresponding suppressed carrier frequency.

5. LSB MODE (Option). Except for the sideband selected, this mode is functionally identical to the USB mode.

6. ISB MODE (Option). Selection of this detection mode automatically activates separate IF filters independent of the front panel IF bandwidth selection. Both upper and lower sidebands are separately and simultaneously demodulated.

   The stereo phones jack provides the USB component of the signal on the tip contact and the LSB component of the signal on the ring contact. With mono headphones, only the USB component of the signal will be heard.

   On the rear panel, lower sideband information will be available at the ISB AUDIO terminals of TB2. Upper sideband information will be available at the AUDIO LINE terminals of TB1.

2.4.7 IF BANDWIDTH (kHz)

One of the following IF bandwidth switches must be selected when in the AM, FM or CW detection modes; in the other three detection modes IF bandwidth is inoperative. Available bandwidths are: 0.3 kHz, 1.0 kHz, 3.2 kHz, 6 kHz, and 16 kHz.

2.4.8 BFO OFFSET

These thumbwheel switches are activated only in the CW detection mode. The BFO offset is ± 8.9 kHz (from 455 kHz) in steps of 100 Hz. The BFO signal is injected after the IF bandwidth filters, thus ensuring that the pitch is independent of IF bandwidth. Switching to "0" of the "+, 0, -" section of the switch automatically tunes the BFO to 455 kHz, regardless of the setting of the numerical sections.

2.4.9 TUNED FREQUENCY READOUT

This seven-digit readout displays the tuned frequency of the receiver. Each digit is a seven-segment LED with intensity controlled by a single potentiometer located inside the receiver. The least-significant digit, at the far right, indicates 10's of Hz. Tuned frequency is displayed for both local and remote control of the receiver.

2.4.10 MANUAL TUNING MODULE (OPTIONAL)

The tuned frequency of the receiver is controlled from the front panel. On versions of the receiver, not including the Manual Tuning Module, remote inputs on the rear panel establish tuned frequency. For these remote control receivers, the IF bandwidths may also be selected from the remote location.

1. TUNING KNOB. Rotating the knob clockwise increases tuned frequency; counterclockwise rotation decreases tuned frequency. Continuing to tune past the end of the range causes the receiver to step to the opposite end of the band and to continue tuning in the same increasing or decreasing frequency direction. The receiver tunes from 00.00000 MHz to 29.99999 MHz, useable above 5 kHz.

2. TUNING DISABLE. Engaging this button locks the receiver to the frequency currently being displayed. Any other tuning-related button engaged will be released and the tuning knob disabled. Also, by engaging this button, the receiver may be tuned remotely, if this option is installed. Depressing any tuning button slightly releases all buttons and also disables tuning.

3. 10 kHz BUTTON. With this button engaged, only the four most-significant digits of the readout can be varied by the tuning knob. The 1 kHz, 100 Hz, and 10 Hz digits will be locked to the frequency indicated when the 10 kHz button was engaged.

4. 1 kHz BUTTON. With this button engaged, the five most-significant digits of the readout can be varied by the tuning knob. The two least-significant digits will be locked to a fixed frequency.

5. 100 Hz BUTTON. With this button engaged, only the 10 Hz digit is locked to frequency. All others are available for tuning.

6. 10 Hz BUTTON. With this button engaged, all digits are available for tuning.

2.4.11 PHONE LEVEL

Rotating the front panel PHONE LEVEL control clockwise increases the output of both the PHONE AUDIO terminals at TB2 and the stereo PHONES jack on the front panel.

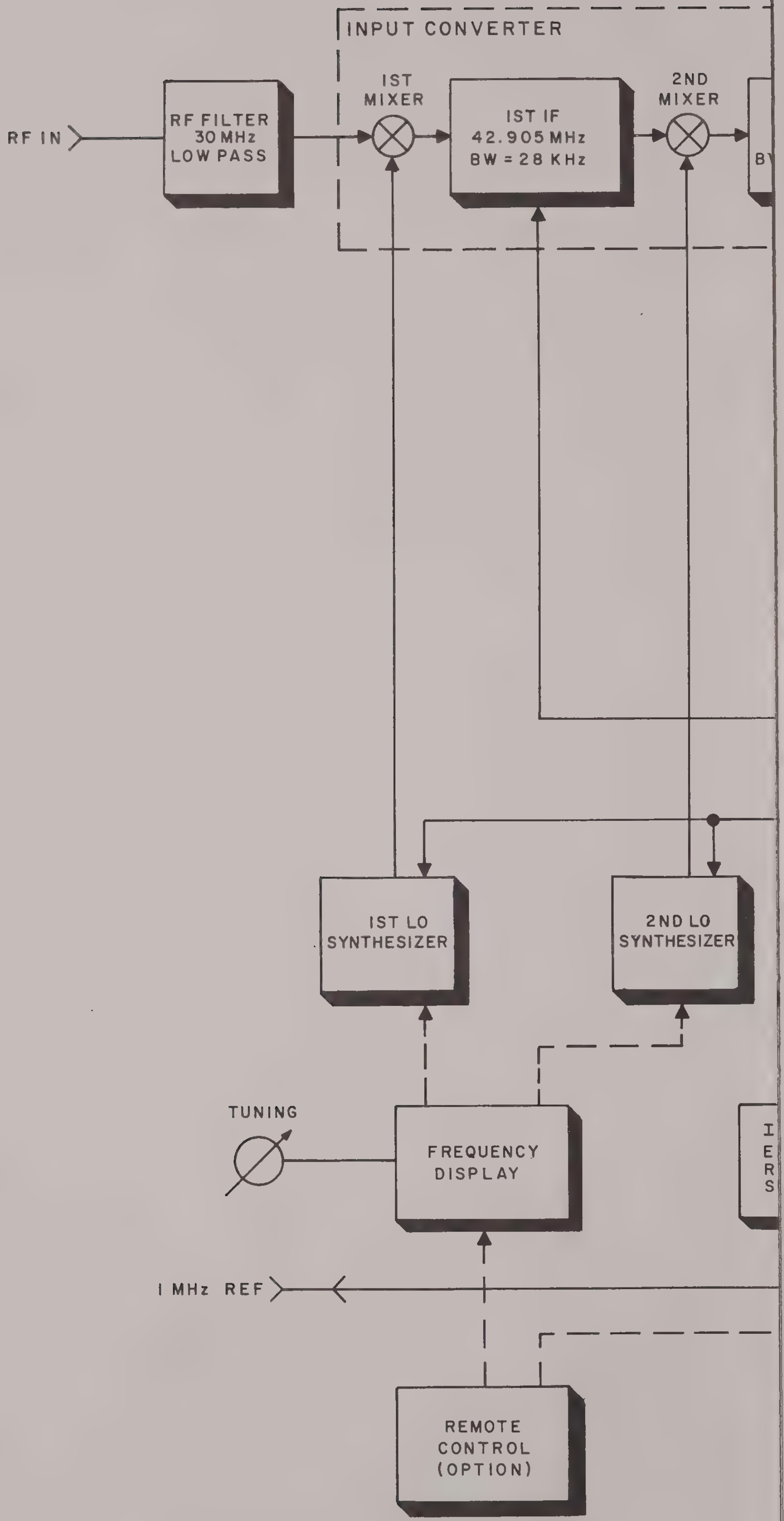

INPUT CONVERTER
RF IN
RF FILTER
30 MHz
LOW PASS
IST
MIXER
IST IF
42.905 MHz
BW = 28 KHz
2ND
MIXER
IST LO
SYNTHESIZER
2ND LO
SYNTHESIZER
TUNING
FREQUENCY
DISPLAY
I MHz REF
REMOTE
CONTROL
(OPTION)

Figure 3-1. WJ-8718 Overall Block Diagram

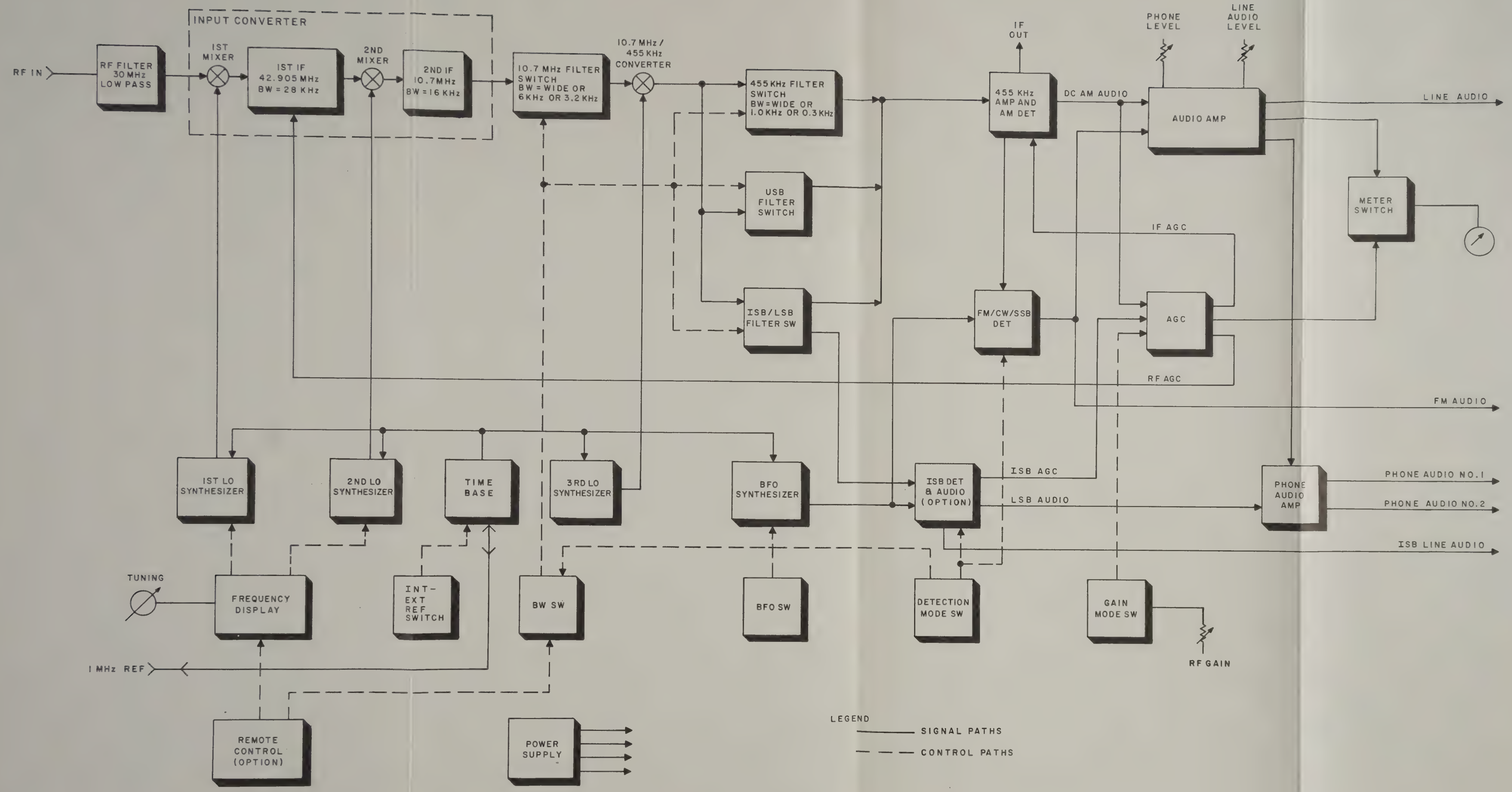

INPUT CONVERTER
RF IN
RF FILTER 30 MHz LOW PASS
1ST MIXER
1ST IF 42.905 MHz BW = 28 KHz
2ND MIXER
2ND IF 10.7MHz BW = 16 KHz
10.7 MHz FILTER SWITCH BW = WIDE OR 6KHz OR 3.2 KHz
10.7 MHz / 455 KHz CONVERTER
455 KHz FILTER SWITCH BW=WIDE OR 1.0 KHz OR 0.3 KHz
USB FILTER SWITCH
ISB/LSB FILTER SW
IF OUT
455 KHz AMP AND AM DET
DC AM AUDIO
PHONE LEVEL
LINE AUDIO LEVEL
AUDIO AMP
LINE AUDIO
METER SWITCH
IF AGC
FM/CW/SSB DET
AGC
RF AGC
FM AUDIO
1ST LO SYNTHESIZER
2ND LO SYNTHESIZER
TIME BASE
3RD LO SYNTHESIZER
BFO SYNTHESIZER
ISB DET & AUDIO (OPTION)
ISB AGC
LSB AUDIO
PHONE AUDIO AMP
PHONE AUDIO NO. 1
PHONE AUDIO NO. 2
ISB LINE AUDIO
TUNING
FREQUENCY DISPLAY
INT-EXT REF SWITCH
BW SW
BFO SW
DETECTION MODE SW
GAIN MODE SW
RF GAIN
1 MHz REF
REMOTE CONTROL (OPTION)
POWER SUPPLY
LEGEND
SIGNAL PATHS
CONTROL PATHS

Figure 3-1. WJ-8718 Overall Block Diagram

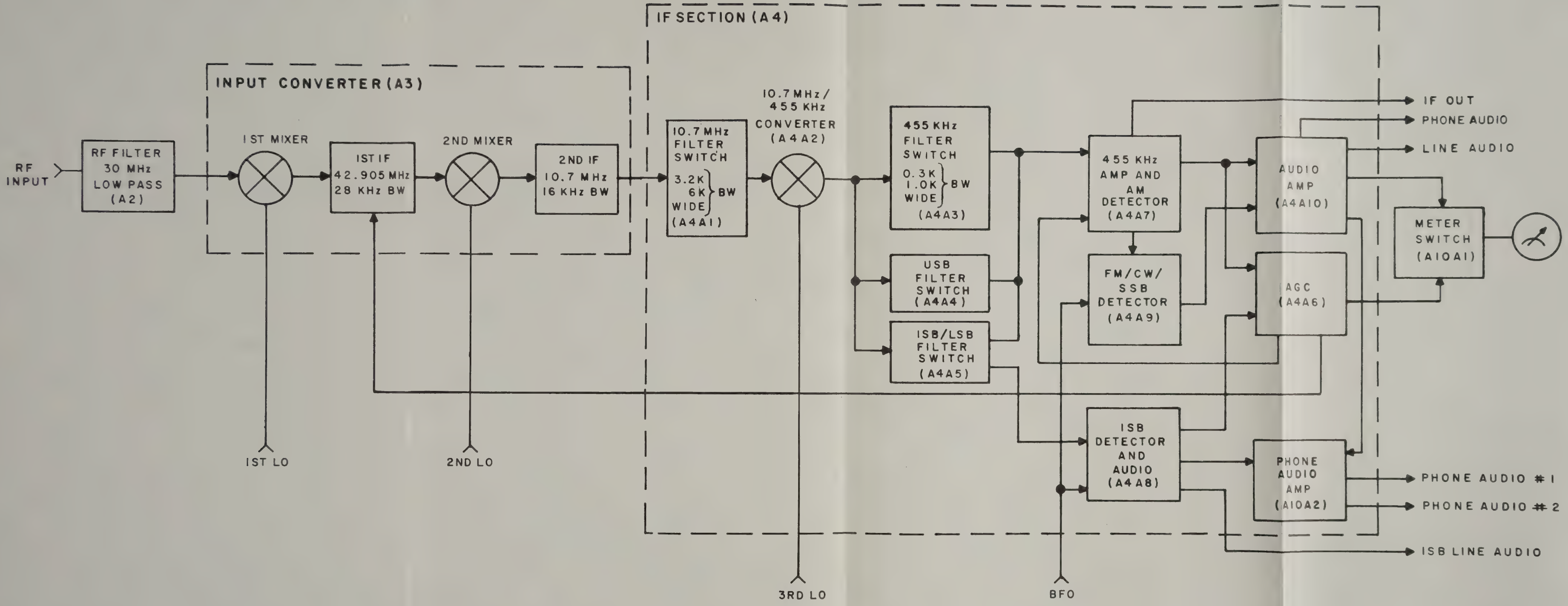

IF SECTION (A4)
INPUT CONVERTER (A3)
RF INPUT
RF FILTER 30 MHz LOW PASS (A2)
1ST MIXER
1ST IF 42.905 MHz 28 KHz BW
2ND MIXER
2ND IF 10.7 MHz 16 KHz BW
10.7 MHz FILTER SWITCH 3.2K 6K BW WIDE (A4A1)
10.7 MHz/ 455 KHz CONVERTER (A4A2)
455 KHz FILTER SWITCH 0.3K 1.0K BW WIDE (A4A3)
USB FILTER SWITCH (A4A4)
ISB/LSB FILTER SWITCH (A4A5)
455 KHz AMP AND AM DETECTOR (A4A7)
FM/CW/ SSB DETECTOR (A4A9)
ISB DETECTOR AND AUDIO (A4A8)
AUDIO AMP (A4A10)
AGC (A4A6)
PHONE AUDIO AMP (A10A2)
METER SWITCH (A10A1)
IF OUT
PHONE AUDIO
LINE AUDIO
PHONE AUDIO #1
PHONE AUDIO #2
ISB LINE AUDIO
1ST LO
2ND LO
3RD LO
BFO

Figure 3-2. Receiver Section, Functional Block Diagram

SECTION III
CIRCUIT DESCRIPTION

3.1 GENERAL

This section describes the various circuits of the WJ-8718 HF Receiver. For coherence in description, the receiver is divided into four functional sections: receiver, synthesizer, digital control, and power supply. A functional description precedes detailed descriptions of the four functional sections. The discussions of the receiver, synthesizer, digital control, and power supply sections consist of schematic descriptions introduced by detailed functional descriptions. Functional block diagrams are included where required. This section is arranged in a functional sequence rather than a numerical sequence to facilitate progressive reading. The table of contents should be consulted for locating descriptions of specific circuits. It is assumed that the reader of this section is familiar with the preceeding sections of this manual.

The unit numbering method is used for identification of electrical components in this receiver. Each circuit board or assembly part carries a prefix before the usual class letter and item number. For example, the full designation for R1 on circuit board A4 is A4R1. Paragraph 5.1 should be consulted for further understanding of the unit numbering method. These prefixes are omitted on illustrations and in text except where necessary to avoid confusion.

3.1.1 OVERALL DESCRIPTION

The WJ-8718 Receiver, shown in Figure 3-1, is a triple-conversion, superhetrodyne receiver which operates in the frequency range from 5 kHz to 30 MHz. It has selected bandwidths between 0.3 kHz and 16 kHz and demodulators for AM, FM, CW signals. Sideband reception, ISB, LSB, and USB, are available as optional detection modes. Tuning is in discrete 10 Hz steps, locked by frequency synthesizers to an internal or external frequency standard for accuracy and stability. The power supply section provides regulated voltages of +15 V, -15 V, and +5 V.

3.2 RECEIVER SECTION

3.2.1 FUNCTIONAL DESCRIPTION

Refer to the receiver functional block diagram, Figure 3-2. Signals enter the receiver via the RF IN connector on the rear panel. The RF Filter accepts signals between 5 kHz and 30 MHz. These signals are passed to the Input Converter, which includes the 1st Mixer, 1st IF Amplifier, 2nd Mixer, and a portion of the 2nd IF Amplifier. The 16 kHz bandwidth of the Input Converter is determined by a crystal filter in the 2nd IF Amplifier. The signals within this bandwidth enter the 10.7 MHz Filter Switch which contains two crystal filters and a wide bandwidth signal path all of which are selectable. In the 10.7 MHz/455 kHz Converter, the signal is changed to the 3rd IF frequency. This signal is then applied in parallel to the 455 kHz Filter Switch, and (if they are installed) the optional USB Filter Switch and optional ISB/LSB Filter Switch. In the 455 kHz Filter Switch are two more crystal filter paths, 1.0 kHz and 0.3 kHz bandwidth and a wideband path to the 455 kHz Amplifier and AM Detector. In the optional USB Filter Switch is a 2.95 kHz wide crystal filter centered above 455 kHz for upper sideband reception. The optional ISB/LSB Filter Switch has a similar filter centered below 455 kHz for lower sideband reception. Table 3-1 shows how these filters are used to control the receiver bandwidth when various bandwidths and detection modes are selected.

Table 3-1. Receiver Bandwidth and Selected Bandwidth Relationships

Selected Detection Mode and Bandwidth	Input Converter Bandwidth	10.7 MHz Filter Switch Bandwidth	455 kHz Filter
AM, FM or CW			
16 kHz	16 kHz	16 kHz	16 kHz
6 kHz	16 kHz	6 kHz	16 kHz
3.2 kHz	16 kHz	3.2 kHz	16 kHz
1.0 kHz	16 kHz	16 kHz	1.0 kHz
0.3 kHz	16 kHz	16 kHz	0.3 kHz
ANY BANDWIDTH			
USB	16 kHz	16 kHz	USB
LSB	16 kHz	16 kHz	LSB
ISB	16 kHz	16 kHz	USB & LSB

From this point, the output of the 455 kHz filters, the signal flow and circuit operation are controlled by the Detection Mode switches whose functions are summarized in Table 3-2. For all detection modes a filtered 455 kHz signal is sent to the 455 kHz Amplifier/AM Detector. And in all detection modes the AM detector output is processed by the AGC and used for IF gain control, RF gain control and Signal Strength Meter voltage.

In the AM mode, the AM detector supplies AM audio through part of the Audio Amplifier (to the Phone Level control) and the Line Audio Level control on the rear panel.

In the FM mode, the limiter and discriminator portion of the FM/CW/SSB Detector energizes and receives an amplified 455 kHz signal from the 455 kHz Amplifier. FM audio then passes through the Audio Amplifier, as well as the Phone Level and Line Audio Level controls.

For the CW, and optional USB, and LSB modes, the BFO and the product detector portion of the FM/CW/SSB Detector is enabled and uses the amplified 455 kHz signal as indicated in Figure 3-2. The product detector audio output passes through the Audio Amplifier to the phone level and line audio level controls.

In the optional ISB mode, the circuits described above operate the same as for the USB mode. In addition, the LSB signal is fed to the ISB Detector and Audio which duplicates portions of the 455 kHz amplifier, product detector, AGC and audio amplifier circuits. LSB audio is applied to the ISB audio level control and one section of the phone level control. The other section of the phone level control is still supplied with USB audio. As a result, the PHONES jack on the front panel, which is a three-conductor type, will have both USB and LSB audio available in the ISB mode if suitable headphones (i.e., 600 Ω, "stereo" type) are used. For all other detection modes the Phone Audio will be available at the PHONES jack.

Table 3-2. Detection Mode Output Signal Relationships

DETECTION MODE	AM DET	FM DET	CW DET & BFO	LINE AUDIO SIGNAL	ISB AUDIO SIGNAL
AM	ON	OFF	OFF	AM	OFF
FM	ON	ON	OFF	FM	OFF
CW	ON	OFF	ON	CW	OFF
USB	ON	OFF	ON	USB	OFF
LSB	ON	OFF	ON	LSB	OFF
ISB	ON	OFF	ON	USB	LSB

3.2.2 TYPE 791616 RF FILTER (A2)

The first module in the receiver's signal path is a 14-pole, low-pass RF Filter, whose schematic is shown in Figure 6-1. It restricts the signals entering the receiver to the intended frequency band of 5 kHz to 30 MHz. Over this frequency range, its attenuation is less than 1 dB, rising slightly at the ends of the range. Above 30 MHz, the attenuation increases rapidly. This stopband attenuation determines the image rejection and the conducted LO leakage of the receiver. Without this attenuation the receiver would have full sensitivity to signals in the image frequency band between 85.8 MHz and 115.8 MHz. Also, the 1st LO, which tunes from 42.9 MHz to 72.9 MHz would have an easy path from the 1st Mixer, which follows the RF Filter to the RF IN connector where it could become an RFI source. However, over both of these frequency bands, the filter attenuation is greater than 80 dB. The RF Filter also protects the rest of the receiver from damage due to excessive signal levels in the filter passband. Diodes CR1, CR2, VR1 and VR2 conduct when signals greater than +15 dBm enter the RF IN connector shunting the excessive energy away from the receiver. Resistor R1 provides a dc path to discharge any static electric charge which might exist at the RF input.

The values of inductors and capacitors are critical to the filter performance and close tolerance parts are used. Care must be taken if it becomes necessary to open the RF Filter enclosure since the physical orientation of the parts, particularly the inductors, affect both its passband and stopband response.

3.2.3 TYPE 791592 INPUT CONVERTER (A3)

All signals entering the Input Converter from the RF Filter are converted up in frequency and filtered. Signals passed by the 1st IF Filter are amplified and converted down in frequency to 10.7 MHz. Here they are further amplified and filtered. The overall net gain of the Input Converter is roughly +12 dB when zero gain control current is applied. The schematic diagram of the Input Converter is shown in Figure 6-2.

Signals reaching the 1st mixer, A1U1, may be any frequency from 5 kHz up to slightly above 30 MHz and any level from the noise floor to +30 dBm. In general, many signals will be present covering a wide range of levels. The role of the 1st mixer is to handle these in such a way that the balance of the receiver can select the desired signal and reject all others. To accomplish this, a high level mixer is used and relatively large, +20 dBm, local oscillator power is applied. The conversion loss of the first mixer is approximately 6 dB. Therefore, the 1st mixer is followed by an amplifier to restore the signals to their original levels. This amplifier uses a grounded gate FET, A1Q2, to obtain a low noise figure, a good terminating impedance for the mixer, and a large signal handling ability. To set the operating point of A1Q2, a constant current source, A1Q1 and its associated circuitry are used. Due to the variation between FET's, the effects of temperature, and other conditions of the circuit, the dc voltage at the collector of A1Q1 and the source of A1Q2 may range from about 0.5 V volt to greater than 3 V.

The output load for A1Q2 is transformer A1T1 which is broadly tuned by A1C3 to ensure a proper driving impedance for the 1st IF crystal filter A1FL1. This filter requires a 50 Ω source and load and has a center frequency of 42.905 MHz and a 3 dB bandwidth of 28 kHz. The primary function of A1FL1 is to reject as many as possible unwanted signals which are passed by the RF Filter and 1st Mixer.

Signals passed by A1FL1 are coupled to a second amplifier, A2Q2, through a coupling network consisting of L1 and A2C11. This amplifier is very similar to A1Q2 and has a similar constant current source biasing it. Its output circuit is also a broadly tuned transformer, but is shunted by gain control diode A2CR2. As the current through the diode increases, its RF impedance decreases and the net gain of A2Q2 is decreased. Current to A2CR2 is supplied by the RF Gain portion of the AGC, A4A6. As the current varies from zero to maximum, there is approximately 30 dB of gain reduction.

The output signal of A2Q2 is down converted by the 2nd Mixer, A2U1. The 2nd LO signal enters the Input Converter via A2J1 at a level of 0 dBm.

Common emitter amplifiers, A2Q5 and A2Q6, provide enough gain to bring the 2nd LO signal to a nominal level of +17 dBm. Each of these stages are broadly tuned transformer-coupled and each has some unbypassed emitter resistance to preserve a relatively low harmonic content to the 2nd LO signal.

The 2nd mixer is followed by a bipolar cascode amplifier. It consists of common emitter stage A2Q4 and common base stage A2Q3. These provide relatively high gain with good stability and low noise contribution. Transformer A2T2 couples the output of A2Q3 to crystal filter A2FL1. This filter has a center frequency of 10.7 MHz, a bandwidth of 16 kHz, and requires 50 Ω terminations.

The received signal frequency which corresponds to the center of the 2nd IF at exactly 10.7 MHz depends on the frequencies of both the 1st and 2nd LO's. The variation of these two oscillators is described in the Synthesizer Section.

3.2.4 TYPE 791569 IF MOTHER BOARD (A4)

The schematic diagram of the IF Motherboard can be found on the Main Chassis Schematic Diagram, Figure 6-20. The IF Motherboard has 11 positions for plug-in circuit cards. With the ISB option installed, a total of 10 positions are used and the eleventh is a spare.

3.2.5 TYPE 791594 10.7 MHz FILTER SWITCH (A4A1)

The 10.7 MHz Filter Switch has two basic functions: it selects one of three signal paths as part of the receiver's overall bandwidth determining scheme and it provides additional IF amplification. The schematic diagram of this module is shown in Figure 6-3.

All six transistors, Q1 through Q6, act as switches and amplifiers. Only two will be on at a time. When Q1 and Q2 are biased on, the 3.2 kHz crystal filter FL1 is engaged restricting the receiver bandwidth to that value. When Q3 and Q4 are on, FL2 is active giving the receiver a 6.0 kHz bandwidth. The path through Q5 and Q6 is quite broad, so when they are selected, the receiver bandwidth through at least the 2nd IF is controlled by the Input Converter at 16 kHz. Which pair of transistors is on is determined by the voltage on the three control lines: pins 15, 17, and 19 of this module. Zero volts turns off a signal path while + 5 V turns it on. The source of these control voltages will be discussed in the Digital Control Section.

A signal entering this module from the Input Converter will pass through a reactive impedance transformer consisting of C31 and L2 which provides the required 50 Ω termination for the output filter of the Input Converter. The signal is applied in parallel to the inputs of Q1, Q3 and Q5. If Q1 or Q3 is on, the signal will be amplified and transformer coupled to the corresponding crystal filter. If Q5 is on, the signal is amplified but not filtered. Potentiometers R7, R22 and R39 serve to equalize the gain of the three signal paths. The signal passes through the corresponding output transistor, Q2, Q4, or Q6 whose output feeds another reactive impedance transformer consisting of L3 and C32.

In normal operation one pair of transistors is always on. The transistors with +5 V applied to their gate (pin 2) will conduct, causing approximately 2 V drop across R34 and R45 which serves to cut off the transistors with zero pin 2 voltage. In the event that no bandwidth selection is made, all three control voltages will be zero and some signal may leak through these paths, but the receiver will appear dead due to further switching which occurs in the 3rd IF.

3.2.6 TYPE 71430 10.7 MHz/455 kHz CONVERTER (A4A2)

The schematic diagram for this converter is shown in Figure 6-4. The 3rd Mixer converts signals from 10.7 MHz to 455 kHz. The 3rd LO at the fixed frequency of 11.155 MHz and a level of approximately -6 dBm is amplified by transistor Q1 and its associated circuitry to roughly +7 dBm before entering the mixer. The amplifier operates as a common emitter stage with some unbypassed emitter resistance to stabilize its gain and reduce distortion. The pi-network, C7-L2-C8, serves as an impedance transformer and low-pass filter further reducing distortion of the LO voltage.

Low-pass filter C9, L3, C10, L4, and C11 filters out undesired components above 500 kHz from the mixer output and matches impedances between the mixer and the following circuits. The sideband structure of the 455 kHz signal is a replica of those which entered the receiver at the RF IN connector. This is not true of the 1st and 2nd IF signals. When a mixer generates an IF frequency which is the difference between an input signal frequency and local oscillator of higher frequency than the input signal, the output has a spectrum which is reversed from the input. Therefore, if a single sideband signal is received which is transmitted as upper sideband, upon reaching the 1st IF the signal would appear to be a lower sideband one. In the 2nd Mixer, the LO is below that mixer input frequency no additional spectral reversal occurs and the 2nd IF signal would also appear to be a lower sideband one. Finally, in the 3rd Mixer, another spectral reversal occurs and the signal again appears as an upper sideband one. This matters primarily when troubleshooting by injecting IF test signals. When a signal is injected into the 1st or 2nd IF, if its frequency is increased, the frequency of the 3rd IF signal will appear to decrease. Remember, however, there is no reversal from the RF input to the 3rd IF.

3.2.7 TYPE 791595 455 kHz FILTER SWITCH (A4A3)

The schematic diagram for this circuit is Figure 6-5. The 3rd IF signal from the 10.7 MHz/455 kHz converter is fed in parallel to the 455 kHz Filter Switch, A4A3, the optional USB Filter Switch, A4A4, and the optional ISB/USB Filter Switch A4A5. The USB Filter Switch and ISB/LSB Filter Switch have relatively high input and output impedances. Therefore, there is no change in the operation of the 455 kHz Filter Switch if the options are not installed.

The 455 kHz Filter Switch is similar in function to the 10.7 MHz Filter Switch. Both contain three possible signal paths, two with crystal filters and one with broad bandwidth. There are, however, several important differences between the two filter switches. The 455 kHz bandwidths are 0.3 kHz when Q1 and Q2 are activated and 1 kHz when Q3 and Q4 are activated. When Q5 and Q6 are activated the broad bandwidth path is energized, thus allowing the overall receiver bandwidth to be controlled by the 10.7 MHz Filter Switch or the Input Converter. In the 455 kHz Filter Switch it is possible for all paths to be off when the USB or LSB filters are selected.

The input signal connects in parallel to Q1, Q3, and Q5. When Q1 is biased on, the signal passes through Q1 and is fed through the 0.3 kHz crystal filter (FL1). The biasing of Q1 and Q2 is controlled by the voltage on pin 19. When this voltage is high (+5 V), the output of U1D will be +12 V to +15 V, thus biasing Q1 and Q2. When this voltage is low (0 V), the output of U1D will be -12 V to -15V which will cause an approximate 1 V reverse bias to the bases of Q1 and Q2 and thus be turned off.

When the 1 kHz bandwidth is selected, module pin 17 is high, and U1A turns on Q3 and Q4. When the 3.2 kHz, 6 Hz, or 16 kHz bandwidths are selected, module pin 15 is high and U1B turns on Q5 and Q6. When ISB, LSB, or USB are selected, all three control lines to this card are low and all three signal paths are inhibited.

All transistors, Q1 through Q6, are operated as common emitter amplifiers with unbypassed emitter resistors to control their gain. Through any of the three signal paths there is a net voltage gain of approximately 3 V from the input to the output of the module. OP AMP section U1C is not used and is as shown in the schematic connected in an inoperative condition.

3.2.8 TYPE 791596 USB FILTER SWITCH OPTION (A4A4)

The schematic diagram for this circuit description is shown in Figure 6-6. The USB Filter Switch is connected in parallel with the 455 kHz Filter Switch at both the input and the output. It functions like a single channel of the other Filter Switch modules previously mentioned. The USB Filter passes signals between 455.25 kHz and 458.2 kHz and amplifies with a net voltage gain of approximately 3 V. Because the passband of the filter is offset above the center of the 3rd IF, this filter passes only the upper sideband information when the receiver is tuned to a signal's carrier frequency. This signal path is enabled when either the USB or ISB detection mode is selected. The USB or ISB detection mode inhibits the operation of the 455 kHz Filter Switch.

The input signal is applied to Q1, which either amplifies it or blocks it depending on the voltage on gate 2. The sources of Q1 and Q2 are both connected to a stable +1.5 V supplied by diodes CR1 through CR3. When pins 49 or 51 are high, gate 2 of both transistors have approximately +4.5 V applied turning them on.

When these control voltages are low (0 V), both transistors are off. Potentiometer R11 is used to adjust the net gain of the signal path for equalization with the gain of the 455 kHz Filter Switch.

3.2.9 TYPE 791597 ISB/LSB FILTER SWITCH OPTION (A4A5)

The schematic diagram for this circuit description is Figure 6-7. The ISB/LSB Filter Switch connects in parallel with the 455 kHz Filter Switch although the ISB/LSB Filter Switch has an additional output. This output feeds into the ISB Detector/Audio module. The LSB filter is offset below the center of the 3rd IF, passing signals between 451.8 kHz and 454.75 kHz. This corresponds to the lower sideband information of a signal whose carrier frequency equals the receiver's dial frequency.

When the LSB detection mode is selected, the signal path through Q1, FL1 and Q2 is enabled and the output flows to the same point as does the signal from the USB Filter Switch or the 455 kHz Filter Switch. When the optional ISB detection mode is selected, the enabled signal path consists of Q1, FL1 and Q3. In this case the LSB signal is sent instead to the ISB detector. Therefore, in ISB operation the USB Filter Switch and LSB Filter Switch act as active signal splitters. Both receive the same composite signal and filter it, sending the selected information to their respective paths for amplification and demodulation.

3.2.10 TYPE 72488 455 kHz AMPLIFIER/AM DETECTOR (A4A7)

The schematic diagram for this circuit description is Figure 6-9. Although received signals are amplified by most of the circuits in the receiver, the majority of the amplification of weak signals takes place in the 455 kHz amplifier of A4A7. Following a two-stage gain controlled amplifier, the input signal is split to provide three outputs: the IF sample which operates the FM/CW/SSB Demodulator, the IF output for the rear panel, and the input to the AM Detector. The AM Detector, which operates at a relatively high level for good linearity, has its output directly coupled to the AGC module and the Audio Amplifier.

FET's Q1 and Q2 operate as common source amplifiers with their gains controlled by a variable voltage applied to gate 2 of each transistor. Inductor L1 broadly tunes the output of Q1 by cancelling any stray capacitance, but the network consisting of L2, C9, C10, C11 and L3 forms a double-tuned bandpass filter of approximately 35 kHz bandwidth. This filter is narrow enough to suppress any broadband noise contributed by earlier stages of the receiver, but at the same time is wide enough not to restrict the receiver's bandwidth. Potentiometer R7 between the first and second amplifier adjusts the maximum gain of the amplifiers and hence of the whole receiver.

Transistor Q3 serves as a buffer between the 455 kHz amplifier and its three outputs. For signals fed to the FM/CW/SSB Detector (pin 13), Q3 acts as an emitter-follower stage. For the rear panel IF Output, Q3 feeds the signal to Q4 which acts as a power amplifier. For the AM detector, Q3 and Q5 both act as common-emitter amplifiers to raise the IF signal to a level of several volts which will permit the detector diode, CR3, to perform linearly. Diodes CR4 and CR5 provide a dc-bias to operate the AM Detector and emitter-follower (Q6) above ground to establish the proper dc level for the AGC circuit.

3.2.11 TYPE 78812 AGC (A4A6)

The primary function of the AGC module is to generate control voltages which adjust the amplification of signals passing through the receiver. When the Fast AGC or Slow AGC gain mode is selected, this module attempts to adjust the receiver's amplification (gain) to maintain a constant output from the AM Detector. If the desired signal entering the receiver should fade in amplitude, the receiver gain would increase just enough to compensate for the fade. When the Manual Gain mode is selected, the receiver's gain is fixed at a level which depends on the setting of the RF Gain potentiometer on the front panel. This module, as a secondary function, provides voltage to operate the signal strength meter.

The differences in decay times of Fast AGC and Slow AGC make them useful for different kinds of signals. In the Fast AGC mode, the gain of the receiver adjusts about as quickly for a rise in signal strength as it does for a fall in signal strength. The time taken to respond to a rise is referred to as attack time, and the time taken for a fall is known as decay time. The response to rising signals remains fast in the Slow AGC mode, but when the signal strength falls the change in gain occurs much more slowly. For AM and FM signals, the total power contained in the carrier and sidebands does not vary much with time at the transmitter. With these types of signals, the main purpose of the AGC is to compensate for atmospheric losses between transmitter and receiver. These changes may occur very slowly or as rapidly as several rises and falls per second. For cases of this sort, the characteristics of the Fast AGC mode will usually serve best. However, for pulsed signals such as telegraphy (A1 emission) and for SSB voice signals (A3J emission) there are rapid fluctuations in transmitted power with recurring peaks. When this type of signal is received, it is usually desirable that the AGC have a sort of memory for the peaks but still be able to respond quickly if there is an abrupt increase in signal level. Hence, the fast attack and slow decay times of the Slow AGC will usually be desired for these cases.

There will also be instances where it is desirable to fix the gain of the receiver at some value to make critical comparisons of signal strength or to eliminate signals or noise below a particular amplitude. For these cases the MAN GAIN mode is useful. When using this mode, it is desirable to adjust the RF GAIN control so that the signal strength meter reads at the MAN SET line for the average signal to be monitored to obtain the greatest latitude for signal level change.

In the following discussion, it may be helpful to consider the simplified AGC circuit Figure 3-3 and the schematic Figure 6-8. In the AGC module, the direct coupled output of the AM detector is filtered by R5 and C3 to limit the speed of response of the Fast AGC. In the Fast AGC Mode, Q7 is biased off, disconnecting C4, so Q1 operates simply as an emitter follower. Q7 is biased on when Slow AGC is selected, grounding the negative end of C4. In this case Q1 can charge C4 quickly if there is a rise in input from the AM Detector, but when the input falls below its peak value Q1 is turned off by the charge stored in C4. Q1 continues to be off until C4 is discharged by R3. This action gives the fast attack response and slow decay response of the Slow AGC mode. Zener diode CR2 acts as a limiter to prevent short bursts of signal from overcharging C4 (which might cut off the amplifiers for many seconds).

OP AMP U1A acts as a buffer between C4 and the following circuits. Transistor Q2 acts as a threshold detector, blocking AGC action for weak signals. This is desirable to allow a minimum signal-to-noise ratio be obtained in all stages of the receiver before any gain reduction is permitted. The base of Q2 is biased to approximately +0.2 V. If the emitter of Q2 is lower than about +0.8 V, Q2 will be turned off and no AGC action can occur. When the output of U1A is greater than +0.8 V, Q2 conducts and a scaled down replica of the AM Detector output appears across R13. When the Manual gain mode is selected, Q3 and Q6 will be turned on and will clamp the voltage on R13 to ground, and +5 V will be applied to the RF Gain potentiometer on the front panel. OP AMP U2B acts as an inverting summing amplifier for the voltage at R13 (which will be zero in MAN Gain mode) and the voltage on the RF GAIN control (which will be zero in FAST or SLOW AGC modes).

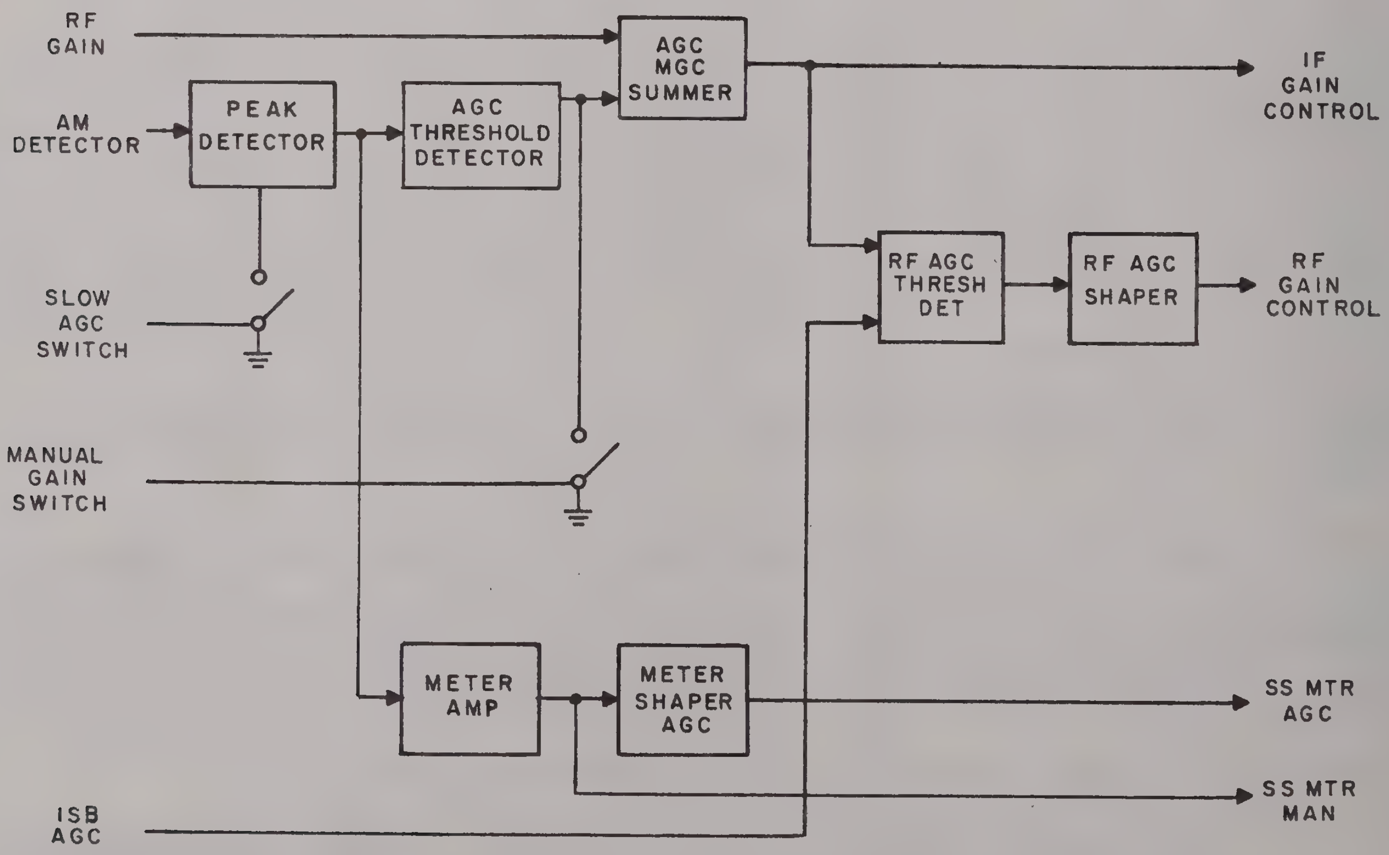

RF GAIN
AM DETECTOR
PEAK DETECTOR
AGC THRESHOLD DETECTOR
AGC MGC SUMMER
IF GAIN CONTROL
SLOW AGC SWITCH
RF AGC THRESH DET
RF AGC SHAPER
RF GAIN CONTROL
MANUAL GAIN SWITCH
METER AMP
METER SHAPER AGC
SS MTR AGC
SS MTR MAN
ISB AGC

Figure 3-3. Simplified AGC Circuit

The output of summing amplifier U2B is buffered by OP AMP U1D and fed to the 455 kHz amplifier on A4A7. Zero volts from U1D allows the 455 kHz amplifier to operate at maximum gain while a negative output from U1D causes the gain of the IF amp to be reduced.

A sample of the IF gain control voltage from U2B is also applied to RF AGC threshold detector Q5. This threshold detector causes the gain reduction to occur only in the 3 rd IF amplifier, unless the signal at the RF input of the receiver and in the early stages of the receiver is great enough to ensure a good signal-to-noise ratio even in the early stages. The operation of the threshold detector is the same as that of Q2, except with polarities reversed to allow for the inversion which occurs in U2B. The base of Q5 is biased around -2.7 V so the IF gain control voltage must be more negative than -3.3 V for Q5 to conduct. When the ISB Detector and Audio module (A4A8) is installed and energized (ISB mode only), a similar AGC circuit in that module supplies a corresponding sample of its IF gain control voltage to Q4. This allows the RF gain control to respond to either the USB component, amplified by A4A7, or the LSB component, amplified by A4A8. This combined action is necessary to protect against possible overload of the 1st and 2nd IF's which are common to both USB and LSB. Q4 duplicates the operation of Q5. When the ISB module is not installed or not selected, Q4 does not conduct and may be ignored.

As stated in the description of the Input Converter, the gain control in the 1st IF amplifier is accomplished by varying the RF impedance of a diode that shunts the load circuit of one stage. The impedance of this diode is approximately inversely proportional to the dc current through it. Therefore, to obtain a 6 dB gain reduction requires a certain current, an additional 6 dB reduction requires doubling the current and another 6 dB reduction requires four times the original current and so on. To achieve the desired relationship between AM Detector output and RF gain reduction requires that the control diode current rise slowly at first, then more rapidly as the received signal strength increases further (exponentially). This current/voltage relationship is obtained through a shaping network comprised of U2D, R27, R28, CR5 and R31. The actual current for the control diode is supplied by buffer U2A.

The relationship between signal strength and the voltage out of U1A make this voltage suitable for operation of the signal strength meter. In the MAN gain mode, this voltage is proportional to the RF input signal voltage. Its polarity is inverted by OP AMP U1C and it is applied through R49 and front panel switches A10A1S1B and S2C to the meter. This allows the receiver to act as a tuned voltmeter whose calibration depends on the setting of the RF GAIN control.

In the AGC modes, the voltage out of U1A increases approximately linearly with signal voltage up to the AGC threshold level of 3 μV (RF input). Above this level the U1A output is compressed by AGC action to be nearly proportional to the logarithm of the RF input voltage. By using a shaping network composed of R41, R50, R51, CR6, CR7, and CR8 to suitably compress the output of U1C at low signal levels, the signal strength meter is made to be approximately linear in dB over a greater than 100 dB range. Resistors R50 and R51 control the amount of compression and the exact fit of the meter scale with signal strength. If an accurate source of variable signal level is available, these fixed resistors may be replaced with variable ones which may be adjusted for best tracking of the meter. The variable resistors may then be removed, measured and replaced with fixed resistors of the same value.

3.2.12 TYPE 791599 FM/CW/SSB DETECTOR (A4A9)

For FM reception this module contains a limiter and discriminator. Power for these circuits is supplied when the FM detection mode is selected. For CW or SSB reception, there is a product detector which has its power applied when the CW, USB, LSB or ISB detection modes are selected. Also, when the product detector is energized, the BFO Synthesizer is enabled and its output is applied to the product detector. The schematic diagram for the following circuit discussion is Figure 6-11.

The IF output sample of approximately 10 mV from the 455 kHz amplifier of A4A7 is the input signal for this module. It is applied to both demodulators although only one is actuated at a time. When FM is selected, the control input at pin 41 is high (+5 V) and Q2 and Q1 are turned on. This applies approximately +9 V to limiter U1. The input signal is amplified and clipped by cascaded stages within U1, so its output is free of any amplitude variations. The extent to which the amplitude variations are removed contributes to the AM rejection of the receiver when receiving FM. The output of the limiter drives the Foster-Seele discriminator. Diodes CR1 and CR2 rectify the composite signals fed to them by C7 and T1. When the signal from the limiter is at exactly 455 kHz, T1 is tuned so that equal and opposite voltages are produced across load resistors R6 and R7, giving a net output of zero to buffer U3A. For inputs slightly off 455 kHz, the voltages on R6 and R7 do not cancel causing a positive output for inputs above 455 kHz and a negative for those below 455 kHz. (Note that these polarities are reversed by U3C, so the output of the module will go negative when the signal frequency increases.) Proper adjustments of L1 will make the output voltage vary linearly with input frequency over ±8 kHz from 455 kHz. At the output of U3A, a lowpass filter, L3 and C11, reduce higher frequency noise components which are present in the discriminator output.

When the CW mode or any of the sideband modes is selected, the control input on pin 43 is high (+5 V). This turns on Q4 and Q3 applying +9 V to balanced modulator U2. The BFO is also applied to U2 (approximately a 40 mV level). This allows U2 to act as the 4th mixer in the signal path as described in the Synthesizer Relationships Section. Its action may be considered to down-convert IF signals to the audio frequency range. For sideband signals, proper tuning of the receiver places the BFO at the frequency corresponding to the carrier frequency of the received signal. This causes the audio components out of U2 to reconstruct those of the original signal transmitted. For CW signals, the BFO is offset from the signal either by use of the BFO offset control on the front panel or by shifting the tuned frequency slightly. Either method will cause an audible tone at the audio output when a signal is present.

When the narrowest IF bandwidth is used, however, the receiver tuning may only be offset a small amount without forcing the signal out of the passband so the BFO offset must be used to produce a tone in the middle of the audio range where hearing is most acute.

The output of U2 goes through lowpass filter L2 and C17, which reject higher frequency noise components, to buffer U3B. OP AMP U3C acts as a summing amplifier for the outputs of the FM discriminator or product detector when either is present. It gives different amplifications to these two signals to bring them up to approximately equal levels. The audio output of this module goes to both the Audio Amplifier and the FM Audio terminal of TB2 on the rear of the receiver.

3.2.13 TYPE 7459 AUDIO AMPLIFIER (A4A10)

The Audio Amplifier combines the audio outputs of the AM detector and FM/CW/SSB Detector and feeds them to the LINE AUDIO LEVEL control on the rear panel and the PHONE LEVEL control on the front panel. The signal returned from the wiper of the LINE AUDIO LEVEL potentiometer drives the line audio amplifier. The signal returned from the PHONE LEVEL control drives the auxiliary phone amplifier which feeds the PHONE AUDIO terminals on TB1. A rectifier which samples the output of the line audio amplifiers supplies dc to operate the front panel meter in the LINE AUDIO setting.

When the AM detection mode is selected, the control input to pin 47 is high (+5 V). The output of U1A is roughly +14 V which reverse biases CR1. The gate of FET Q1 will then assume the same potential as its source and Q1 will be on, acting as a closed switch for AM audio. Both demodulators of the FM/CW/SSB Detector will be off so the output of U1D will be AM audio only. When any other detection mode is selected, the control input to pin 47 will be low (0 V) and the output of U1A will be approximately -14 V. This will tend to forward bias CR1 and will cause the gate of Q1 to be similarly negative, cutting off all signal flow through Q1. The audio signal from the FM/CW/SSB Detector will appear at the output of U1D.

The signal into line audio amplifier U2 is the output of U1D attenuated by the LINE AUDIO LEVEL control, R1, on the rear panel. The two sections of U2 act as a push-pull bridge amplifier, driving output transformer T2 located on the inside of the rear panel. To permit maximum power output, the amplifier uses the full voltage of the positive power supply rectifier which will be approximately +22 V at normal line voltage. A circuit within U2 provides a bias voltage at pin 1 which is equal to one-half the supply voltage. This is connected to the non-inverting inputs of both amplifier sections of U2. Both amplifiers use unity feedback at dc, that is, the only dc path to the inverting inputs is from the outputs, so there is very little dc difference between their outputs at pins 2 and 13.

The input signal is applied to the non-inverting input of U2B, pin 9. Although pins 6 and 9 are at the same dc potential, pin 6 is bypassed so no ac signal appears there. The operation of amplifier U2B will be clear if pin 7, the inverting input of U2A, is considered to be at ac ground. With this assumption U2B simply appears as a non-inverting amplifier with a closed-loop ac gain of 50. Its ac gain is determined by the ratio of feedback resistors R20 and R19. On the other hand, U2A may then be viewed as an inverting amplifier with an ac gain of nearly one. Its input is the full output of U2B and its gain is determined by R20 and R19 acting as input resistors and R21 as feedback resistor. As with inverting OP AMPS, extremely little signal voltage appears at the amplifier inverting input terminal thus satisfying the assumption made to explain the behavior of U2B. The net gain of the combined amplifier is 100 and its outputs are balanced with respect to ground. Due to the high current U2 can pass, it is grounded separately from the other circuits on the Audio Amplifier module to prevent ground current coupling which might lead to instability and parasitic oscillations.

The output signal of U2A is rectified and filtered to indicate LINE AUDIO level on the front panel meter. The rectifier is a voltage doubler consisting of CR2, CR3, C12 and C13. It responds to peak-to-peak input voltage and is calibrated by resistors R22, R23 and R24 to indicate the RMS value of a sinewave at the LINE AUDIO terminals of TB1 on the rear panel. Its calibration is therefore most accurate for sinewave voltages.

The auxiliary phone amplifier U1B and U1C is a low power bridge amplifier and is therefore similar to U2. It operates from both +15 V and -15 V supplies and has it inputs biased at ground. Comparing its circuit with that of U2 it should be apparent that it also uses unity dc feedback and has a closed loop of 100 for ac signals. Its output current capability is much lower than U2 though, so it can only supply slightly over 100 mW compared to over 2 watts from U2.

If it should be desired to control the LINE AUDIO level from the front panel, it is possible with a simple modification to the IF motherboard. If the lead from J1 pin 14 at the rear end of the IF motherboard to XA10 pin 17 is disconnected, and XA10 pin 17 is connected to XA10 pin 19, the LINE AUDIO level will be controlled by the PHONE LEVEL control on the front panel. In some receivers this will require cutting the printed circuit track from J1 to XA10. If this must be done, use a sharp knife and some care to see that a small gap is made all the way through the copper track.

3.2.14 TYPE 791598 ISB DETECTOR/AUDIO OPTION (A4A8)

The schematic diagram for this circuit description is Figure 6-10. For ISB operation, two independent single sideband signals must be demodulated. Since they share the same carrier frequency, they may be processed together up to a certain point. In this receiver, ISB is handled as a single composite signal through the 3rd mixer. At that point it is split, the USB component being filtered and passed through the main signal path, and the LSB component filtered and separately amplified and demodulated by the ISB Detector and Audio module.

The ISB Detector and Audio module is therefore a combination of circuits from other modules previously discussed. There is a 455 kHz amplifier similar to part

A4A7, a product detector similar to that on A4A9, an AGC circuit like part of A4A6, and an ISB line audio amplifier similar to the auxiliary phone amplifier on A4A10. A sample of the AGC voltage developed in this module is sent to the main AGC module to produce a combined RF AGC. If this module is not installed in the receiver, operation in any mode except ISB will not be affected.

Common source FET amplifiers Q1 and Q2 have variable gain depending on their gate 2 voltage. This voltage is derived from the module's AGC section. Potentiometer R8 is used to set the maximum gain of the amplifier to give a compatible input level to balanced modulator U1 as is received by A4A9U2 at low signal levels. To adjust maximum gain, tune to an AM signal of about a 1 μ V level and set R8 so that equal USB and LSB outputs appear at the front panel PHONES jack.

Balanced modulator U1 uses the BFO to act as a 4th mixer and converts the LSB signal to audio. Its output is low-pass filtered and then amplified by U3A. The output of U3A splits three ways. It leaves the module to go to the front panel which provides LSB phone audio in the ISB mode. It also feeds the ISB Line Audio amplifier through level control R36 and drives the AGC circuit.

The AGC is a simplified form of the one on A4A6. It always acts in the Slow AGC mode. Peak detector Q4, charges C19 which discharges through R52. Buffer U2D drives AGC threshold detector Q3. The output of Q3 is amplified by U3D to supply the IF AGC to amplifiers Q1 and Q2 via buffer U3C and the sample to the RF AGC circuit on A4A6. No meter outputs are supplied by this module.

The ISB Line Audio amplifier is identical, except for component values, to the auxiliary phone amplifier on A4A10.

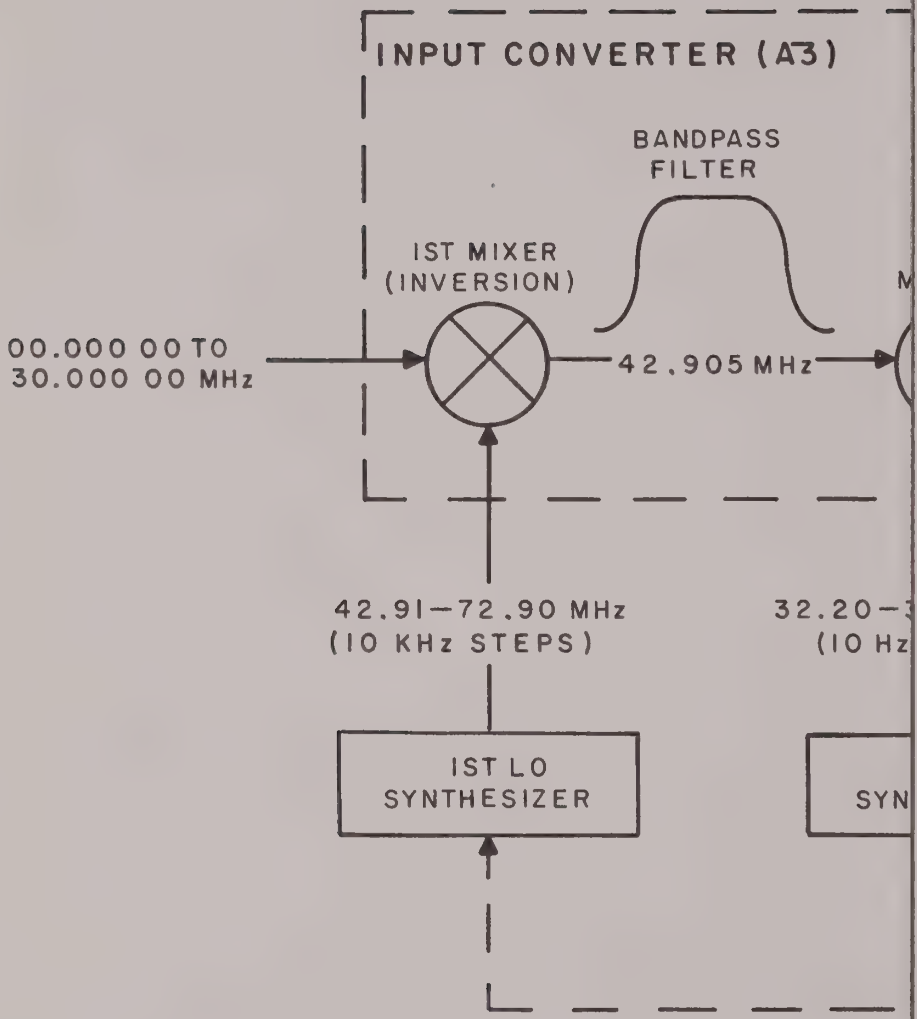

INPUT CONVERTER (A3)
BANDPASS FILTER
IST MIXER (INVERSION)
00.000 00 TO 30.000 00 MHz
42.905 MHz
42.91–72.90 MHz (10 KHz STEPS)
32.20–
(10 Hz
IST LO SYNTHESIZER
SYN

Figure 3-4. Frequency Synthesizers Functional Relationship

3.3 SYNTHESIZER SECTION

3.3.1 SYNTHESIZER RELATIONSHIPS

Figure 3-4 shows the relationship of the synthesizers to the receiver signal processing. In essence, three synthesizers translate all RF input signals to 455 kHz. Other stages of the receiver then demodulate this 455 kHz IF. If the receiver operates in the CW or a sideband mode, a 4th synthesizer signal beats with the 455 kHz IF to produce an audio output. The tuning process involves the 1st and 2nd LO; the 3rd LO is fixed at 11.155 MHz and the BFO varies ±8.9 kHz from 455 kHz.

The 1st LO tunes from 42.91000 MHz to 72.90000 MHz in 10 kHz steps. This range corresponds to an RF input range of 00.00000 MHz to 29.99000 MHz. All RF input signals convert to signals in a 10 kHz range from 42.900 to 42.910 MHz by the 1st Mixer. A filter follows the 1st Mixer which passes signals in this 10 kHz range plus sidebands extending approximately 9 kHz beyond each end of this range.

The 2nd LO tunes from 32.20001 MHz to 32.21000 MHz in 10 Hz steps. This range provides translation of these signals to 10.7 MHz in the 2nd Mixer. A 16 kHz bandpass filter follows the 2nd mixer to limit the signal range.

The 3rd LO provides a 11.15500 MHz signal to the 3rd Mixer. Signals centered on the 10.7 MHz output from the 2nd Mixer mix with the signal from the 3rd LO to produce signals centered at 455 kHz. The output from the 3rd Mixer passes through another bandpass filter to be either demodulated by other stages in the receiver or mixed with the BFO for CW or Sideband detection.

The BFO Synthesizer produces a signal ranging from 446.1 kHz to 463.9 kHz. This range centers about 455 kHz (±8.9 kHz) and beats with the 455 kHz signal from the 3rd Mixer to produce an audio output.

All four synthesizer stages are synchronized by a common Time Base. Reference frequencies of 1 MHz, 50 kHz, 40 kHz, 10 kHz, and 1 kHz are supplied from a 2 MHz temperature compensated crystal oscillator (TCXO).

Table 3-3 provides an example of frequency translation from the RF input to the output of the 3rd Mixer. This translation begins with an RF input signal of 00.00000 MHz (column A) and ends with a signal centered at 455 kHz. Columns B and C are tabulated for input frequencies of 00.00500 and 00.00999 MHz, respectively. These three input frequencies fall into the lowest 10 kHz range of the 1st LO, 42.91 MHz. If the RF input signal was tuned higher than 00.00999 MHz but less than 00.01999 MHz, the 1st LO would step up to its next LO frequency, 42.92 MHz.

Any signal in the range of 00.00000 to 29.99999 MHz converts to a 1st IF frequency in the range of 42.90001 to 42.91000 MHz. Since all the example inputs of Table 3-3 fall into the first 10 kHz tuning segment of the 1st LO, the 1st LO frequency is 42.91000 MHz.

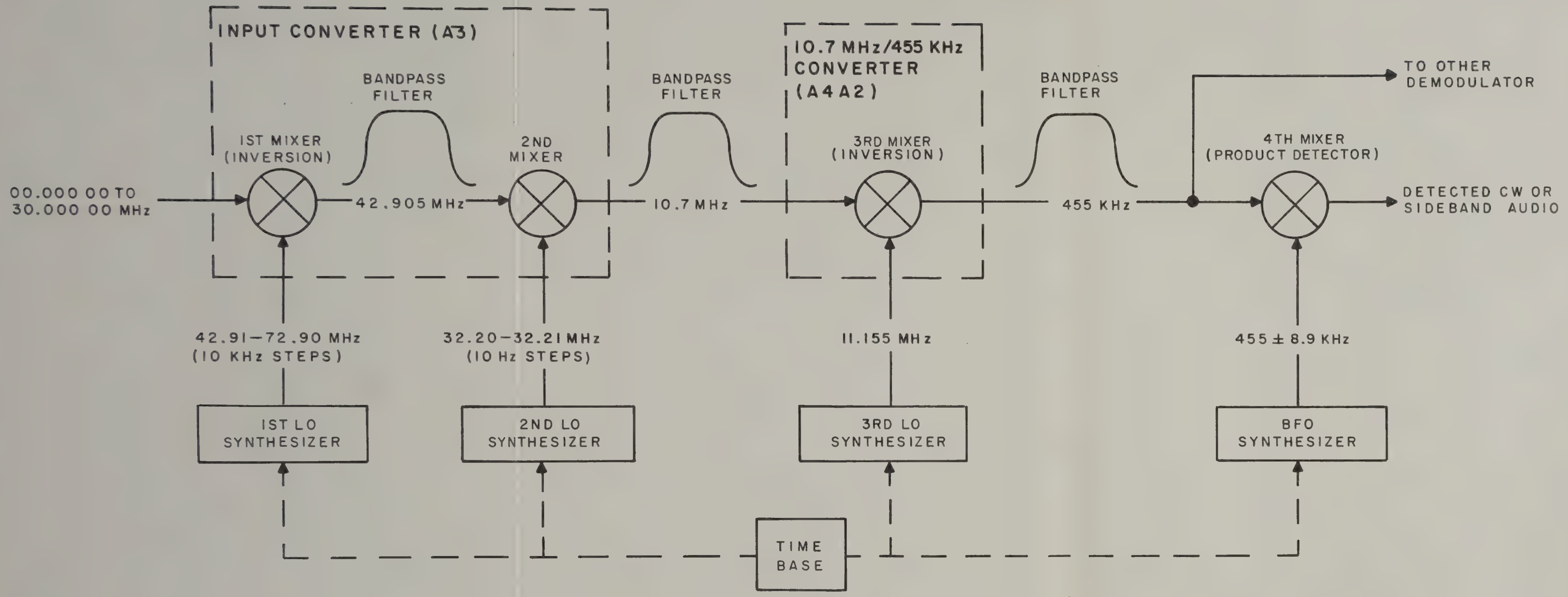

INPUT CONVERTER (A3)
BANDPASS FILTER
1ST MIXER (INVERSION)
2ND MIXER
00.000 00 TO 30.000 00 MHz
42.905 MHz
BANDPASS FILTER
10.7 MHz
10.7 MHz/455 KHz CONVERTER (A4A2)
3RD MIXER (INVERSION)
BANDPASS FILTER
455 KHz
TO OTHER DEMODULATOR
4TH MIXER (PRODUCT DETECTOR)
DETECTED CW OR SIDEBAND AUDIO
42.91–72.90 MHz (10 KHz STEPS)
32.20–32.21 MHz (10 Hz STEPS)
11.155 MHz
455 ± 8.9 KHz
1ST LO SYNTHESIZER
2ND LO SYNTHESIZER
3RD LO SYNTHESIZER
BFO SYNTHESIZER
TIME BASE

Figure 3-4. Frequency Synthesizers Functional Relationship

3.3 SYNTHESIZER SECTION

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Table 3-3. 1st and 2nd LO 10 kHz Tuning Increment

	RF INPUT	(00.00000 MHz)	(0.00500 MHz)	(0.00999 MHz)
1st MIXER	1st LO	42.91000	42.91000	42.91000
	RF INPUT	-00.00000	-00.00500	-00.00999
	1st IF	42.91000	42.90500	42.90001
2nd MIXER	1st IF	42.91000	42.90500	42.90001
	2nd LO	-32.21000	-32.20500	-32.20001
	2nd IF	10.70000	10.70000	10.70000
3rd MIXER	3rd LO		11.15500	
	2nd IF		-10.70000	
	3rd IF		0.45500	
4th MIXER	3rd IF	0.455		
	BFO	0.455 ±8.9 kHz		DEMODULATION
	AUDIO	±8.9 kHz		

Table 3-4. 1st and 2nd LO Frequencies Versus Tuned Frequency

To Obtain 1st and 3rd LO Frequencies for Any Tuned Frequency
Example Frequency 15.75635 MHz

TO OBTAIN 1st LO FREQUENCY	TO OBTAIN 2nd LO FREQUENCY
Use 4 Most Significant Digits From Readout	Use 3 Least Significant Digits From Readout
15.75000	00.00635
Add 42.91 to these Digits	Subtract them from 32.210 00
Add 15.75 42.91 58.66 = Frequency 1st LO	Subtract 32.21000 -.00635 32.20365 = Frequency 2nd LO

The 2nd Mixer translates the signals in the 1st IF range to the 2nd IF frequency of 10.7 MHz. The 2nd LO steps in 10 Hz increments from 32.20001 to 32.21000 MHz. This 9.99 kHz range of the 2nd LO works with the increment sizes of the 1st LO to provide a translation of all 1st IF signals to 10.7 MHz. The corresponding 2nd LO frequencies are shown in Table 3-3 along with the resultant 2nd IF of 10.7 MHz. To determine the 1st LO and 2nd LO frequencies corresponding to a received RF frequency, refer to the examples in Table 3-4.

The 3rd Mixer translates the 10.7 MHz 2nd IF to 455 kHz. A fixed 3rd LO frequency of 11.15500 MHz provides the necessary difference frequency for this translation. The 3rd IF resultant is shown only in column B. Demodulation of the 3rd IF takes place either in the 4th Mixer (product detector) or in other stages of the receiver.

The product detector combines the 455 kHz signal from the 3rd Mixer with the 455 ±8.9 kHz variable BFO signal. The resultant signal from Mixer 4 (a product detector) is an audible tone for monitoring.

3.3.2 PHASE LOCK LOOPS

3.3.2.1 General

The phase lock loops used in this receiver consist of four basic components: a phase detector, a low-pass filter, a voltage controlled oscillator (VCO), and a divider (counter). A basic phase lock loop configuration is shown in Figure 3-5. The divider component of the phase lock loop may be fixed or programmable. Both are used in this receiver. This section describes the two types of phase lock loops and explains the phase detector, which is common to all the synthesizers.

3.3.2.2 Basic Phase Lock Loop

The basic phase lock loop technique compares the frequency and phase of incoming reference signal to the output of the voltage controlled oscillator (VCO). If the two signals differ in frequency and/or phase, an error voltage is generated by the phase detector and applied to the VCO, causing it to correct in the direction required for

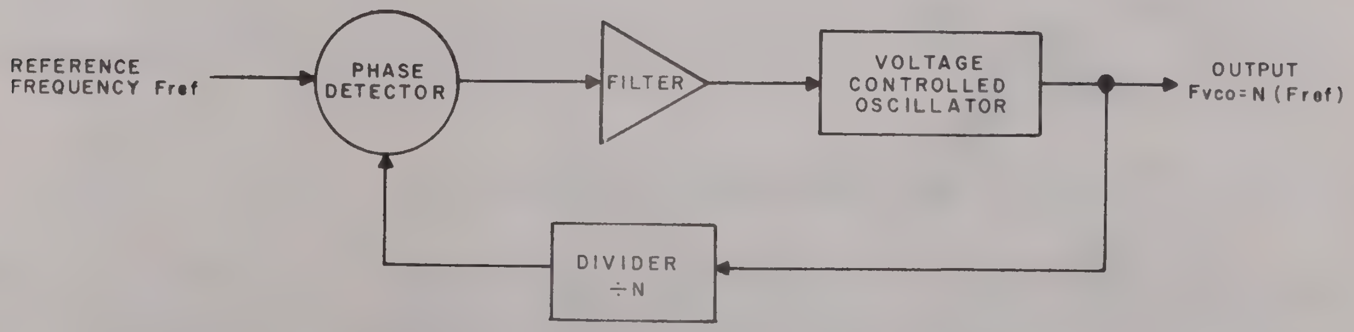


Figure 3-5. Basic Phase Lock Loop Configuration

decreasing the frequency/phase difference. The correction procedure continues until lock is achieved, after which the VCO will track the incoming reference signal.

Dividing a VCO output by two before applying it to the phase detector results in an error voltage that drives the VCO to twice the reference frequency. A divide-by-3 action results in an error voltage that drives the VCO to three times the reference frequency. From this, the following relationship can be given:

$$F_{vco} = N\,(F_{ref})$$

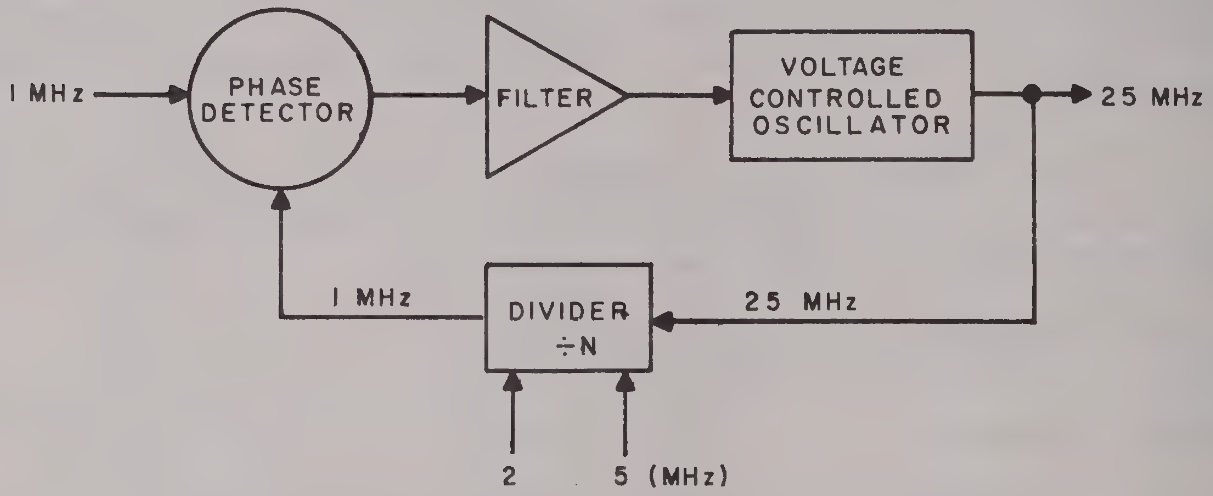


Figure 3-6. Programmable Phase Lock Loop

An example of the basic phase lock loop technique, using numbers, will provide an understanding of its actual operation. Referring to Figure 3-6, the desired frequency is obtained by programming the variable divider through selectable inputs. Assuming the VCO is locked at the desired frequency of 25 MHz, this signal enters the input of the (in this case) divide-by-25 counter (divider). The counter emits a pulse at its output each time 25 pulses enter its input. Therefore, dividing the 25 MHz input by 25 results in an output of 1 MHz. This 1 MHz signal is compared to the reference frequency of 1 MHz indicating a locked situation. If the divider's output had been less than 1 MHz, the phase detector would have produced pulses to drive the VCO to a higher frequency. Similarly, if the divider's output had been greater than 1 MHz, the VCO would have been driven to a lower frequency. An important concept to be noted here is that the phase lock loop's output is dependent upon the selectable inputs of the variable divider.

3.3.2.3 Phase Lock Loop Prescaling Technique

A variation of the basic phase lock loop, shown in Figure 3-7 is utilized in the 1st and 2nd LO Synthesizers. The divider portion consists of a two modulus prescaler and two programmable counters. The two-modulus (divisor) prescaler accepts the output from the VCO and divides it by one of two numbers (P, P+1). In these synthesizers, the prescaler in the 1st LO consists of a divide-by-50/51 counter and the 2nd LO prescaler consists of a divide-by-100/101 counter. The swallow counter controls the number of times the prescaler divides by P+1. The programmable counter counts the number of pulses from the prescaler. Totally, these three components provide for coarse (Np) and fine (A) tuning of the VCO.

In operation, the prescaler divides by P+1, A times. For every P+1 pulse from the prescaler, both the A counter and Np counter are decremented by 1. The prescaler divides by P+1 until counter A reaches its zero state. At this point, the modulus of the prescaler changes to P. The prescaler then divides by P until the remaining count, (Np-A) in the Np counter, decrements to zero. At this time the output of Np emits a pulse while the A and Np counters reset. The cycle then repeats.

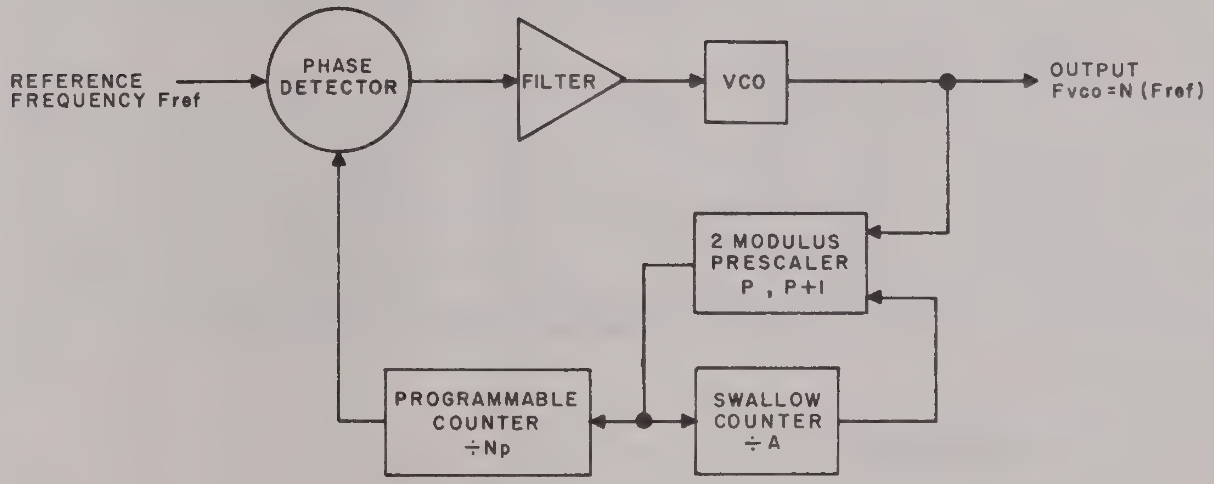
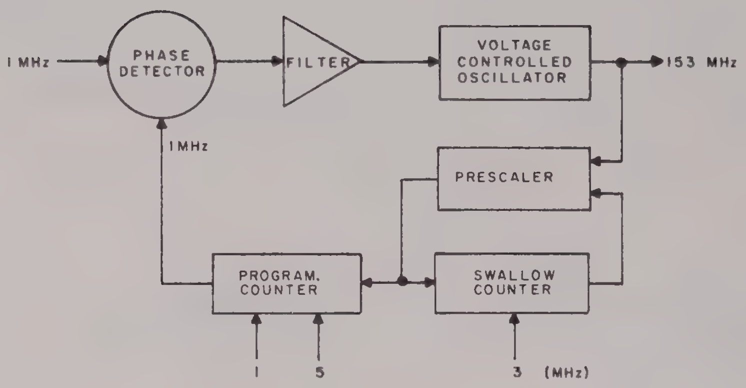


Figure 3-7. Two Modulus Prescaling in the Phase Lock Loop

An example of the two-modulus prescaling technique is given in Figure 3-8. For illustration, a VCO output of 153 MHz is desired. Selected into the programmable counter are the two most significant digits, 1 and 5. Selected into the swallow counter is the least significant digit, 3. Under lock conditions, the divider has an input of 153 MHz and an output of 1 MHz.

To produce a 1 MHz signal from a 153 MHz signal results in a divide ratio of 153. The table in Figure 3-8 shows a count sequence with 153 input pulses resulting in one output pulse. Similarly, a 153 MHz input results in a 1 MHz output. The programmable counter emits a pulse every time it counts 15 pulses. With the swallow counter set to three the prescaler divides-by-11 three times and then switches to the divide-by-10 state. At this point, the programmable counter needs 12 input pulses before emitting an output pulse. The prescaler then divides-by-10 twelve times to finish the count sequency. With 3 counts of 11 (3x11=33), and 12 counts of 10 (12x10=120), one output pulse emits from the programmable counter every 153 input pulses (33+120=153).

The two phase lock loop types described are used throughout the WJ-8718 synthesizer section. The 1st LO and part of the 2nd LO utilize the prescaler configuration while the 3rd LO and another part of the 2nd LO use a fixed divide-by-N ratio. The BFO uses the basic phase lock loop configuration, utilizing the divide-by-N technique (Fvco=N Fref). Common to all the synthesizers in this receiver is the phase detector used. It will be described in detail below.



PROGRAM COUNTER	SWALLOW COUNTER	PRESCALER COUNTS	INPUT PULSES
15	3	0	0
14	2	11	11
13	1	11	22
12	0	11	33
11	-	10	43
10	-	10	53
9	-	10	63
8	-	10	73
7	-	10	83
6	-	10	93
5	-	10	103
4	-	10	113
3	-	10	123
2	-	10	133
1	-	10	143
0	-	10	153

153 INPUT PULSES=1 OUTPUT PULSE

Figure 3-8. Prescaler Dividing Technique

3.3.2.4 Phase Detector

The Phase Detector used in all of the synthesizer is actually a phase and frequency detector. The integrated circuit also includes a charge pump and an amplifier. Each of these three sections will be discussed below. Table 3-5 provides some information about the phase detectors in these synthesizers.

Table 3-5. Receiver's Phase Detector Characteristics

Synthesizer		Phase Detector		Programmable Divider ?	VCO Range	Output Frequency
		Ref. Des.	Ref. Freq.			
1st LO		U5	40 kHz	YES	171.64-291.60 MHz	42.91-72.90 MHz
2nd LO	32M	U1A, B	1 MHz	NO	32 MHz	
	PROG	U12A, B	10 kHz	YES	200-210 MHz	
	OUT	U6A, B	200-210 kHz	NO	32.20-32.21 MHz	32.20-32.21 MHz
3rd LO		U22A, B	5 kHz	NO	11.155 MHz	11.155 MHz
BFO		U9A, B	1 kHz	YES	4461-4639 kHz	446.1-463.9 kHz

The phase detector receives a fixed reference frequency at one input (R) and a variable frequency at input (V) from the divider section. The output responds only to transitions from the two inputs and has four output states as shown in Figure 3-9. If the frequency and phase match exactly, outputs U and D remain high. If the variable input leads in phase with respect to the reference input, U remains high and D goes low. If the variable input lags in phase with respect to the reference input, D remains high and U goes low. When inputs V and R are separated by a frequency difference, the output at pins U or D varies high and low at a rate proportional to the difference frequency of the two inputs.

Under lock conditions, when the input of both V and R are identical in phase and frequency, the output pulses from U and D will be extremely narrow and appear on an oscilloscope as spikes. For a large difference between the two input frequencies, as when a new BFO frequency is established, the outputs respond as described above with wide pulses appearing on the proper outputs.

The charge pump accepts both outputs from the phase detector and translates the voltage levels before they are applied to the loop filter. The input to pin 11 appears as an inverted output at pin 10. The input to pin 4 appears as an output at pin 5. There will be a pulsed waveform entering either pin 4 or pin 11 at any given time. When either pin 11 or pin 4 is high, the charge pump produces an error signal that lowers the VCO frequency. The charge pump delivers voltage commands from 2.25 volts on positive swings to 0.75 volts on negative swings, with a mean value of 1.5 volts.

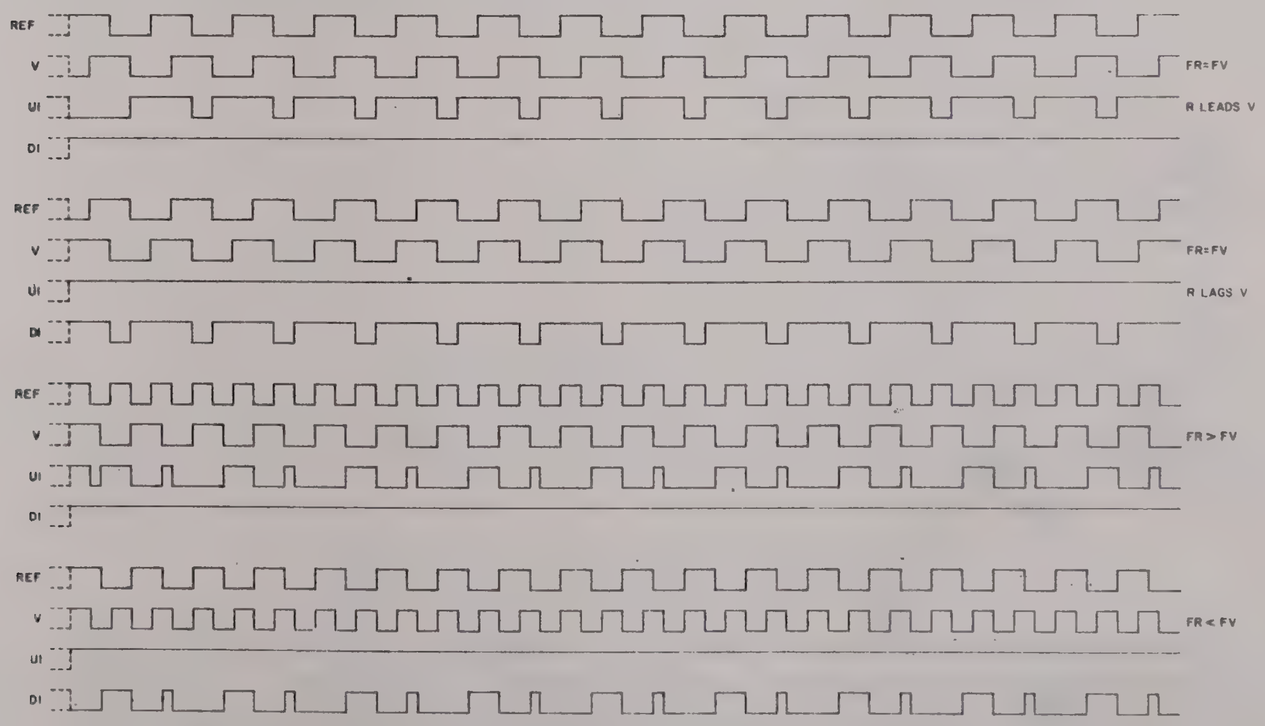


Figure 3-9. Phase Detector Timing Diagram

The lead-lag active filter normally uses the amplifier contained in the phase detector IC plus external resistors and capacitors. In some cases an external transistor will also be used or even an external OP AMP. This filter has a direct influence on loop bandwidth, capture range, and transient response. Its output on pin 8 is the VCO tuning voltage.

3.3.3 TYPE 791600 TIME BASE CIRCUITS (A5A1A2)

The Time Base Circuits are part of the Type 791600 board, A5A1A2. The time base circuits have two sources of reference from which to choose. A functional description is given along with the functional block diagram shown in Figure 3-10. Reference designations are included in the diagram and correlate with the time base portion of the 1st and 3rd LO/Time Base Schematic, Figure 6-15.

3.3.3.1 Functional Description

The Time Base shown in Figure 3-10 can be controlled internally with a 2 MHz temperature compensated crystal oscillator (TCXO) and divide-by-2 frequency divider, or with a 1 MHz external source. This 1 MHz reference is divided down to 50 kHz, 40 kHz, 10 kHz, and 1 kHz. Buffer amplifiers Q6 and Q7 are used for isolation purposes. Synthesizers that need certain reference frequencies are listed below each frequency in the diagram. Refer to the schematic diagram in Figure 6-15 for the following circuit description of the Time Base Circuits.

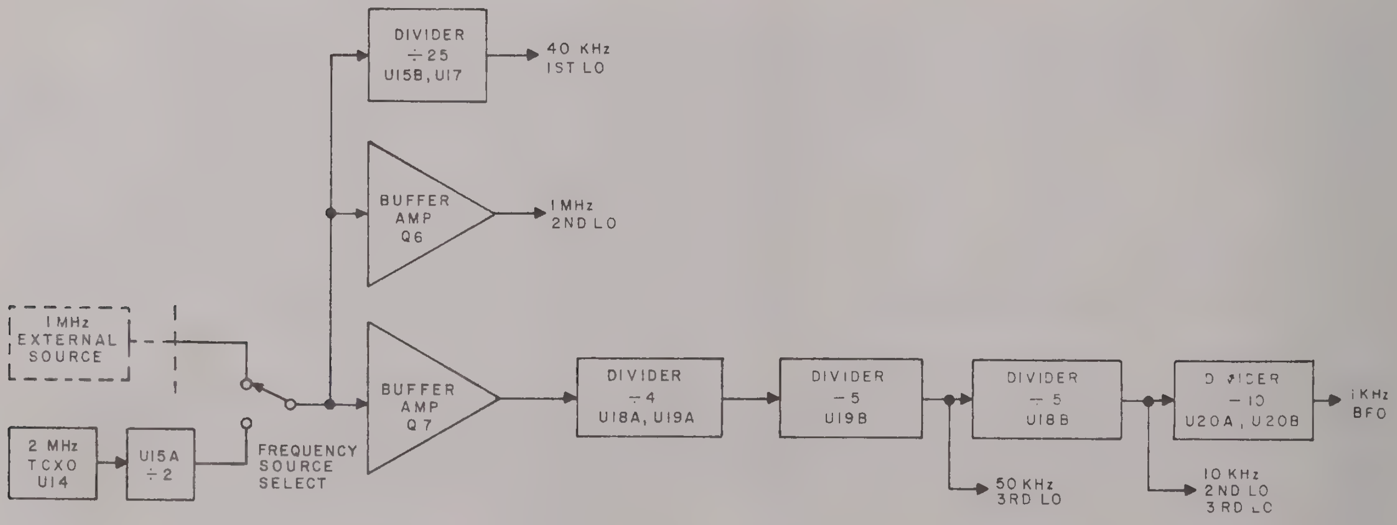

DIVIDER ÷25 U15B, U17
40 KHz 1ST LO
BUFFER AMP Q6
1 MHz 2ND LO
1 MHz EXTERNAL SOURCE
2 MHz TCXO U14
U15A ÷2
FREQUENCY SOURCE SELECT
BUFFER AMP Q7
DIVIDER ÷4 U18A, U19A
DIVIDER ÷5 U19B
DIVIDER ÷5 U18B
DIVIDER ÷10 U20A, U20B
1 KHz BFO
50 KHz 3RD LO
10 KHz 2ND LO 3RD LO

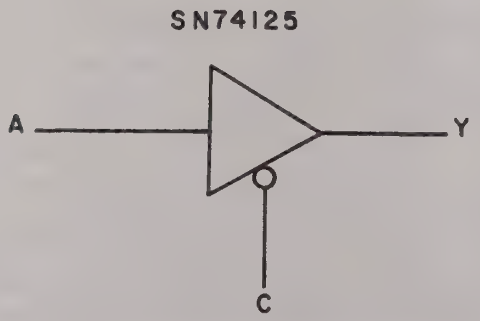
Figure 3-10. Time Base Circuits Functional Block Diagram

3.3.3.2 Circuit Description

An internal source of reference comes from a 2 MHz TCXO, while an external source of reference must be a 1 MHz signal of approximately 50 mV. Tri-state buffers accomplish the switching of internal and external reference sources. A truth table of the tri-state buffers used is given in Figure 3-11. Getting information from input A to output Y depends upon the state of input C. Information passes from input A to output Y when the state of input C is low. Similarly, information is inhibited from the output when the state of input C is high.

When operating with an external source of reference, the external select (EXT SEL) line is grounded and the internal select (INT SEL) is pulled high by R84, and the externally supplied 1 MHz reference is seen at pin A17, EXT IN. The internal 1 MHz reference is inhibited when it reaches the high impedance of tri-state buffer U23B. Therefore, the only source for the 1MHz signal to transformer T1 is the external one. T1 and C23 resonate at 1 MHz while the voltage divider of R34 and R35 shifts the 1 MHz signal to a 2.5 Vdc level. This signal enters U16 which converts the sinewave to TTL levels. The output of U16 passes through tri-state buffer U23A and on to the rest of the time base circuits.

Operation with the internal source grounds the internal select (INT SEL) line and allows the external select line to be pulled up by R85. Tri-state buffer U23 allows the 2 MHz signal that is divided to 1 MHz to be passed on to the rest of the circuitry. The 1 MHz reference splits to two parts of the circuit. In one direction, the reference signal passes through U23B and out the EXT IN connection. The signal does continue to pass through U16 but is inhibited at U23A. In the other direction, the reference signal passes to pin 3 of U23A and on to the rest of the circuitry.



U23A
U23B
U23C

TRUTH TABLE

INPUTS		OUTPUTS
A	C	Y
H	L	H
L	L	L
X	H	HI-Z

Figure 3-11. Tri-State Buffers

For either souce of reference, a 1 MHz TTL signal is present at the input of Q6 and U15B. This signal is divided by 25, through U15B and U17, to become a 40 kHz reference for the 1st LO. The 1 MHz signal also passes through an isolation amplifier Q6 to board pin A9 to be used as a reference for the 2nd LO. The 1 MHz signal also passes through another isolation amplifier, Q7, to be divided down to three more reference frequencies.

For either source of reference, a 1 MHz TTL signal is present at the input of Q6 and U15B. This signal is divided by 25, through U15B and U17, to become a 40 kHz reference for the 1st LO. The 1 MHz signal also passes through an isolation amplifier Q6 to board pin A9 to be used as a reference for the 2nd LO. The 1 MHz signal also passes through another isolation amplifier, Q7, to be divided down to three more reference frequencies.

U18A and U19A form a divide-by-4 network whose input is 1 MHz and whose output is 250 kHz. This 250 kHz divides down to 50 kHz through divider U19B and sent to U21B, the digital mixer of the 3rd LO. The output of U19B also enters U18B, whose output is a 10 kHz signal. This signal leaves the board to be used as a reference for the 2nd LO. The 10 kHz signal also passes through a divide-by-10 network, consisting of U20A and U20B, for an output reference signal of 1 kHz.

3.3.4 TYPE 791600 3RD LO SYNTHESIZER (A5A1A2)

The 3rd LO is part of the 1st and 3rd LO/Time Base board, Type 791600. The 3rd LO has an input of two reference frequencies from the time base and a fixed output frequency of 11.155 MHz. The 3rd LO utilizes a basic phase lock loop configuration using a digital mixing technique. A functional description along with a circuit discussion is provided below.

3.3.4.1 Functional Description

Figure 3-12 shows a functional block diagram of the 3rd LO. Included in the diagram are reference designations that correspond to the schematic diagram of the 3rd LO, Figure 6-15. The 3rd LO is part of the 1st and 3rd LO/Time Base schematic diagram and is located in the lower right-hand portion of the schematic.

The 11.155 MHz output of the VCO is isolated from the digital mixer and the 3rd LO output by buffer amplifier Q9. The digital mixer compares its two input frequencies. The 3rd LO output of 11.155 MHz mixes with a harmonic of the 50 kHz reference frequency from the time base resulting in an output of 5 kHz. A 10 kHz time base frequency is divided down to 5 kHz by divider U21A and compared to the digital mixer output in phase detector U22A. The phase detector produces output pulses relative to its two inputs. These different pulses get integrated into a control voltage for the VCO. The VCO varies its output frequency proportional to the control voltage input. The VCO output then passes through Buffer Amp Q9 to complete the loop and produce the 3rd LO output.

3.3.4.2 Circuit Description

The 3rd LO output, found at pin A55 of the 1st and 3rd LO Synthesizer Board (A5A1A2), is roughly a 100 mV rms sinewave. This signal also couples to Q10, through C37, where it is amplified to levels applicable for the digital mixer. The 3rd LO signal is compared to a 50 kHz reference to produce a 5 kHz, if the 3rd LO is locked. This 5 kHz signal from the mixer is compared to a 5 kHz signal from the time base in the phase detector, U22A. The charge pump U22B converts the differences in phase and/or frequency into positive and negative going dc levels. These levels pass through filter U22C and bias varactor diode CR7. The 11.155 MHz crystal oscillator is then driven in the direction to achieve lock. Q8 amplifies the 3rd LO frequency and then passes through buffer amplifier Q9 to complete the loop.

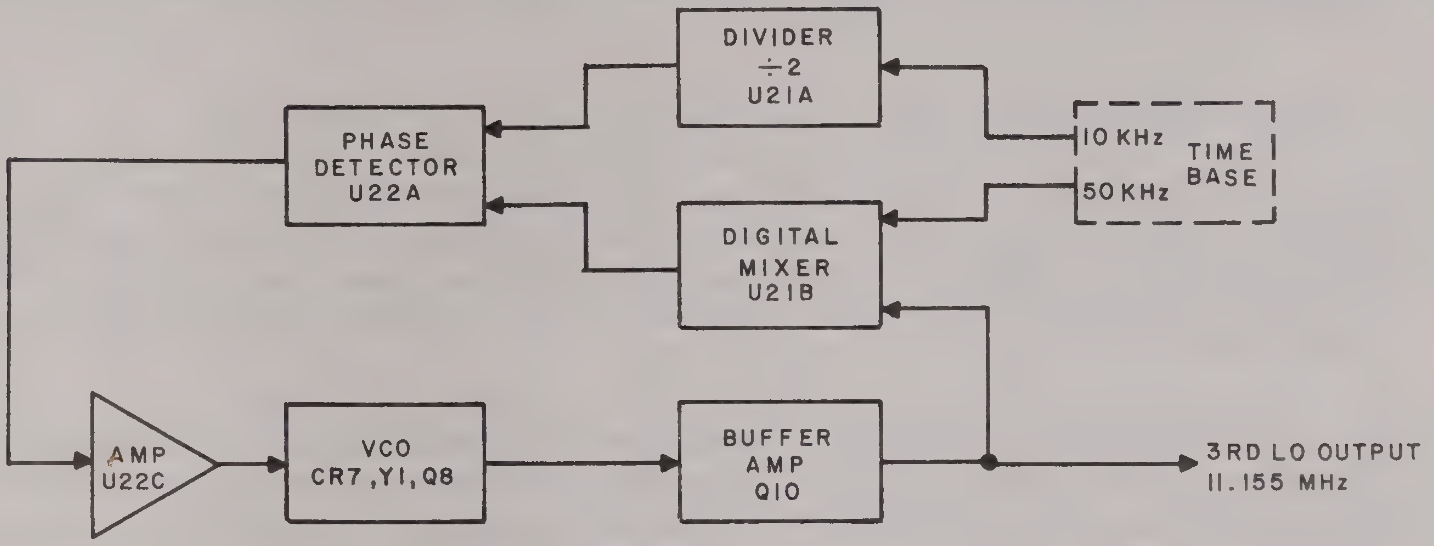


Figure 3-12. 3rd LO Functional Block Diagram

Although the VCO incorporates a 11.155 MHz crystal, Y1, a phase lock loop is still needed. The purpose of the phase lock loop is to vary the oscillator frequency for the purpose of synchronizing it with the time base. With the phase lock loop disconnected, the crystal oscillator can produce a usable output frequency for the 3rd LO but would not be exactly the correct frequency to mix with the 10.7 MHz output of the 2nd mixer.

3.3.5 TYPE 791576 BFO SYNTHESIZER (A5A3)

3.3.5.1 Functional Description

The BFO Synthesizer produces a 455 kHz ±8.9 kHz signal. The BFO therefore tunes from 446.1 to 463.9 kHz in 100 Hz steps. This synthesizer utilizes the basic phase lock loop configuration shown in Figure 3-5. The actual phase lock loop operates at a frequency range of 10 times the BFO output to allow for the use of a 1 kHz reference frequency.

A functional block diagram of the BFO Synthesizer is shown in Figure 3-13. Some reference designations are included in the diagram and correlate with the BFO Schematic Diagram, Figure 6-17. The functional block diagram does not include all external connections and should only be used with this discussion.

The VCO produces a frequency that is distributed to the BFO output connection (via divide-by-10 counter) and to the programmable counter clock inputs. The presettable inputs in conjunction with the end of cycle detector produce a divide-by-N ratio. The end of cycle detector produces pulses which are compared to a 1 kHz reference frequency in the phase detector. The resultant output is pulses that characterize the difference in frequency and phase of the two input frequencies. The loop filter takes the output pulses from the phase detector and integrates them into a varying dc voltage. This varying voltage drives the VCO in the proper direction to re-establish the desired frequency.

3.3.5.2 Circuit Description

The circuit description of the BFO Synthesizer is presented in a sequential manner to facilitate understanding. The BFO phase lock loop will be discussed in the following order: programmable divider, phase detector, charge pump, lead-lag filter, and VCO. Integrated circuit data is supplied where needed. The BFO Synthesizer schematic diagram is shown in Figure 6-17.

Refer to Figure 3-13 to aid in the description of the counters used in the programmable divider. U1, U2, U3, and U4 are BCD synchronous up/down counters. These counters may be programmed, through inputs D, C, B and A, for any initial state, 0 through 9. The ripple clock output and count enable input permit cascading. The ripple clock, normally high, produces a low level pulse during the 9 to 0 transition

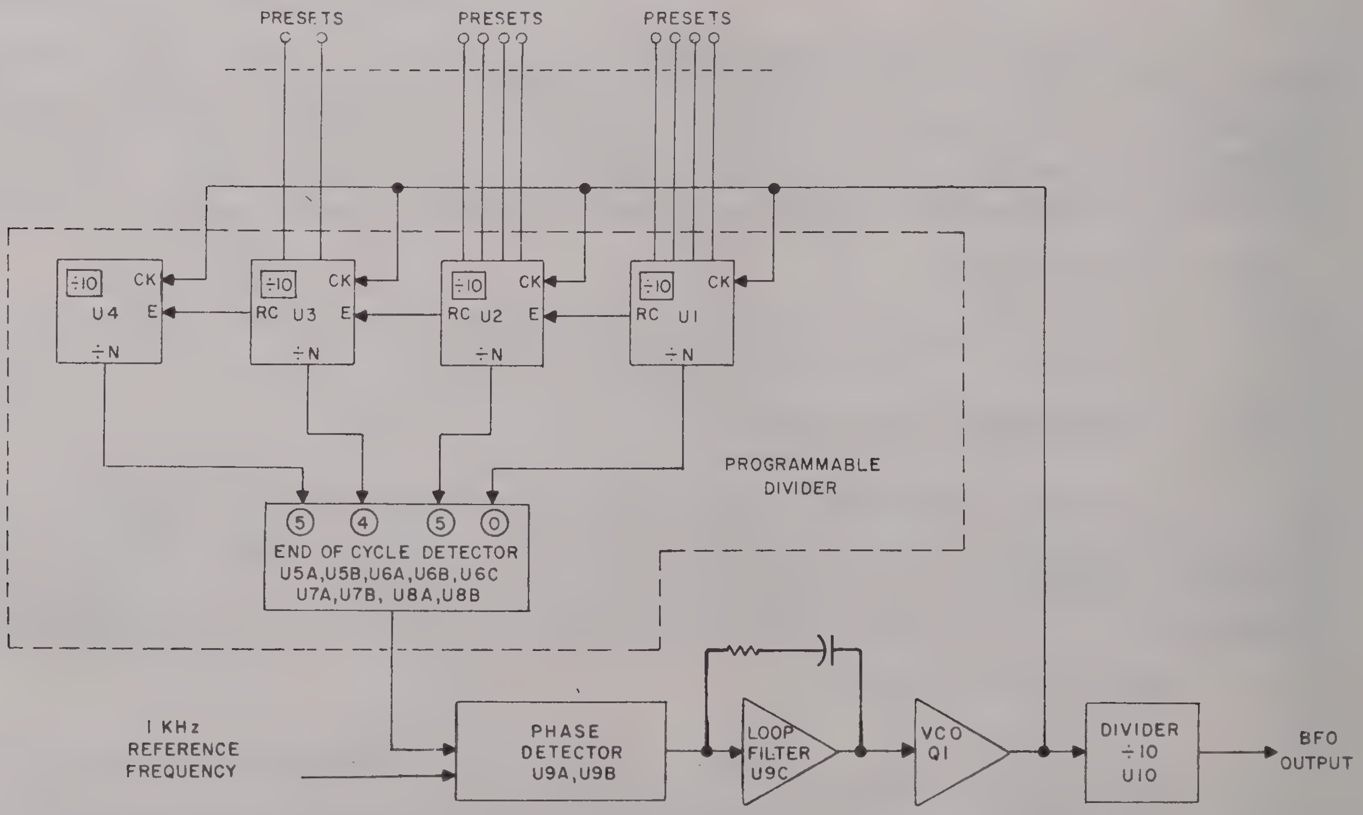

PRESETS
PRESETS
PRESETS
÷10
CK
U4
E
÷N
÷10
RC
U3
CK
E
÷N
÷10
RC
U2
CK
E
÷N
÷10
RC
U1
CK
÷N
PROGRAMMABLE DIVIDER
⑤ ④ ⑤ ⓪
END OF CYCLE DETECTOR
U5A, U5B, U6A, U6B, U6C
U7A, U7B, U8A, U8B
1 KHz REFERENCE FREQUENCY
PHASE DETECTOR U9A, U9B
LOOP FILTER U9C
VCO Q1
DIVIDER ÷10 U10
BFO OUTPUT

Figure 3-13. BFO Functional Block Diagram

when counting up, and during the 0 to 9 transition when counting down. A high at the enable input inhibits counting while a low level input enables counting. The direction of count is determined by the level of the up/down input. When low, the counter counts up and when high, it counts down. Entering a number in the A through D inputs of the counter, when enabled, causes the counter to jump to a preset number from which counting will begin. This preset function is enabled when a low state is applied to the load input.

The programmable divider must produce an output of 1 kHz for any input signal in the range of 4.461 to 4.639 MHz. Therefore, the divide ratio of the programmable counter must be from 4461 (4.461 MHz/1 kHz) to 4639 (4.639 MHz/1 kHz). Because counters U1 through U4 are cascaded (by connecting the ripple clock of one to the enable of another) and have a maximum count of 10000 (10x10x10x10), further modifications are needed.

To reduce the maximum count sequence, an end of cycle detector is used to terminate the count sequence. The end of cycle detector, consisting of U5A, U5B, U6A, U6B, U6C, U7A, and U7B terminates the counting of U4, U3, U2, U1 at 5450. When this number is detected, a pulse is sent to the phase detector and the counters reset.

Now that a terminal count has been established, an explanation of the presettable inputs follows. The preset of U4 is always set (hard wired) to 0000. U3 has two preset inputs which depend on the direction of counting. These inputs to U3 connect to the plus or minus (±) thumbwheel switch for variable BFO selection. Selecting a negative (-) BFO frequency enters a 1001 into U3 and the counters count up. Selecting a positive (+) BFO frequency enters a 0000 into U3 and the counters count down. U2 has nine possible preset input states from BCD 0000 to 1000. U1 has 10 possible preset states from 0000 to 1001. Selecting a zero BFO offset (±0.0 kHz) grounds all preset inputs of U1 and U2, loading both counters with 0000. Also, selecting a "0" from the "+, 0, -" thumbwheel grounds all thumbwheel preset inputs causing a zero BFO offset. Refer to the BFO Switch Truth Table, Table 3-8, for further clarification of the BFO Switch operation.

Knowing the possible input values of the divider and the end of cycle detection number, an example will help explain the count sequence (refer to Figure 6-17). Assume that counters U4, U3, U2, and U1 are all loaded with 0000. This corresponds to a BFO frequency of 455 kHz, a VCO frequency of 4.55 MHz, and a BFO thumbwheel setting of 0.0 kHz. A "+" thumbwheel setting initiates down counting. Therefore counting from 0000 down to 5450 results in a divide ratio of 4550. (Note that the next count down from 0000 is 9999). With a divide ratio of 4550, the counters will reach a terminal count 1000 times a second with an input frequency of 4.55 MHz.

Notice that setting the thumbwheel switches to -0.0 kHz indicates the same VCO frequency, 4.55 MHz, but initiates "up" counting. A negative "-" setting enters a 1001 in U3, making the count start from 0900. With an input of 0900 counting up to 5450 results in the same divide ratio of 4550.

Assume a BFO frequency of 460.4 kHz is needed. This corresponds to a thumbwheel selection of + 5.4 kHz, and a VCO frequency of 4.604 MHz. From the thumbwheel selection, a "+" presets U3 with a 0000, a "5" presets U2 with a 0101, and a "4" presets U1 with a 0100. Therefore counting from 0054 down to 5450 results in a divide ratio of 4604. With a divide ratio of 4604, the counters will reach terminal count 1000 times a second with an input frequency of 4.604 MHz.

U8A and U8B have two purposes: to send a pulse to the LOAD input of the counters for presetting and to extend the width of the end of cycle detector's pulse.

The phase detector, U9A, receives a fixed 1 kHz frequency at its reference input, pin 1, and a signal from the divider at its variable input, pin 3. These two signals produce an output that characterizes their differences in frequency and phase. The charge pump, U9B receives this pulsed waveform from the phase detector outputs and translates them to fixed positive and negative-going amplitude levels (centered about 1.5 V).

These levels are filtered and integrated by Lead-Lag Filter, Q4 and U9C, and provide the tuning voltage for the VCO. A more complete understanding of the phase detector can be found in paragraph 3.3.2.4.

Buffer Q4 provides a high-input impedance for the preceeding stage. Positive and negative going pulses at the gate are developed across the source output and applied to inverting amplifier U9C. The output of U9C is coupled back to the gate of Q4, through R3 and C1, providing the integrating action. Potentiometer R1 establishes zero gate to source voltage (Vgs) to Q4.

Emitter-coupled oscillator Q1 with its external tank circuit comprises the VCO. Varactor diode CR1 receives a control voltage from the active filter and adjusts the tank circuit's frequency of oscillation to establish lock. The VCO operates from 4.461 to 4.639 MHz.

The control voltage from the lead-lag filter biases CR1. Resistors R8, R9, and R10 form the dc bias network, and feedback capacitor C7 sustains oscillation along with tuned circuit C8 and L1. R11 and C9 form a low-pass filter for +15 V isolation, and the VCO's output is coupled to the next stage by C10.

Q2 and its surrounding components form a tuned amplifier for the incoming VCO output frequency. This VCO sinewave frequency is then coupled to a sinewave to TTL Converter, Q3. From here, the digital signal returns as the clock input of the programmable divider, and is divided by 10 in U1D, and provided as the BFO output signal.

3.3.6 TYPE 791601 2ND LO SYNTHESIZER (A5A2)

3.3.6.1 Functional Description

The 2nd LO tunes from 32.20001 to 32.21 MHz in 10 Hz steps. This synthesizer utilizes three phase lock loops to produce the 2nd LO output. The functional block diagram of the 2nd LO is shown in Figure 3-14.

The phase lock loop in the upper left section of the diagram has a reference input of 1 MHz from the Time Base and a fixed output of 32 MHz. The bottom phase lock loop is programmable and produces an output from 200 to 210 MHz. This output routes through a divide-by-1000 stage, resulting in a programmable output from 200 to 210 kHz. The third phase lock loop depends on the other two phase lock loops to produce the 2nd LO output.

An explanation of the 2nd LO output loop will clarify the overall operation of this synthesizer. The 2nd LO output routes to mixer U4, where it is combined with the fixed-frequency phase lock loop output of 32 MHz. This mixer then takes the difference of its two input frequencies resulting in an output within the 200 to 210 kHz range. This output is amplified and level translated for TTL compatibility. These two signals are compared in frequency and phase by U6A, whose output characterizes the difference between its two inputs. Filter U6B integrates the phase detector output into a varying dc voltage which drives the VCO to establish the desired frequency. The VCO output is sent through a buffer amplifier whose output is the 2nd LO.

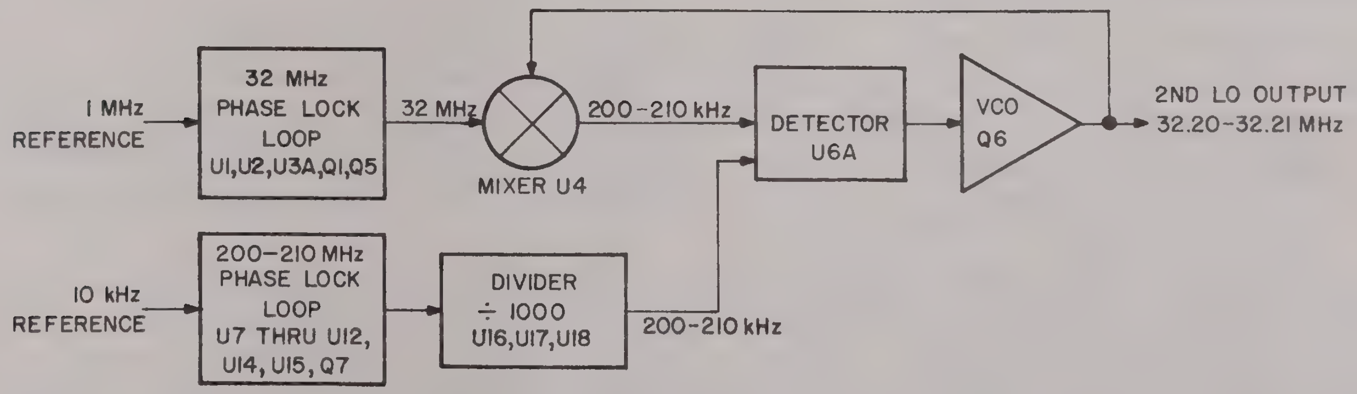

1 MHz
REFERENCE
32 MHz
PHASE LOCK
LOOP
U1,U2,U3A,Q1,Q5
32 MHz
MIXER U4
200-210 kHz
DETECTOR
U6A
VCO
Q6
2ND LO OUTPUT
32.20-32.21 MHz
10 kHz
REFERENCE
200-210 MHz
PHASE LOCK
LOOP
U7 THRU U12,
U14, U15, Q7
DIVIDER
÷ 1000
U16,U17,U18
200-210 kHz

Figure 3-14. 2nd LO Functional Block Diagram

3.3.6.2 Circuit Description

The circuit description for the 2nd LO follows the same organization as the functional description. The 2nd LO will be discussed in the following order: 32 MHz phase lock loop, programmable phase lock loop, and 2nd LO output loop. The schematic diagram for the 2nd LO is shown in Figure 6-16.

The 32 MHz Phase Lock Loop utilizes the phase lock loop configuration shown in Figure 3-5. The output of Q1 routes through a divide-by-2 counter, U3A, and a divide-by-16 counter, U2, dividing the 32 MHz output down to 1 MHz. This signal and the 1 MHz reference from the time base are compared in phase detector, U1A, and filtered in U1B (these circuits are described in paragraph 3.3.2.4). The dc voltage from U1B varies the capacitance of varactor diode CR3. Q5's oscillation depends on the tuned circuit incorporating CR3. Q1 is a buffer amplifier which has two outputs isolated from each other. C9 and L9 passes the 32 MHz signal required while rejecting any harmonics of 32 MHz or any 1 MHz signals from the input of U4.

The programmable phase lock loop incorporates a two-modulus prescaler, swallow counter, divider, phase detector, filter, and VCO. The output of this loop, from Q7, feeds into U15 and U16. U14 and U15 form a prescaler whose divide ratios are 100 and 101. Figure 3-15 illustrates the prescaler operation. Initially U15 is a divide-by-10 or 11 counter and U14 is a divide-by-10 counter. Cascading the two results in divide ratios of 100 and 110 obviously needing additional modifications. U15 divides by 11 when both E5 and E4 are at a low state. This occurs only during the swallow counting sequence when E4 is held low by U11C. U15 divides by 10 for 90 input pulses from the VCO. Because of this, nine input pulses enter U14 at pin 2. At this point U14's ripple clock output, pin 15, goes low for one input pulse. This enables U15 to divide by 11 once. Therefore, dividing by 10 nine times (9x10) and dividing by 11 once (1x11) results in a divide ratio of 101 (90+11). This division of 101 occurs until the swallow counter (U7 and U8) reach terminal count. From this point, E4 of U15 remains high until the divider reaches terminal count, thus dividing by 10. U11B and U11C detect the state of the swallow counter while U11D detects the terminal count of the divider.

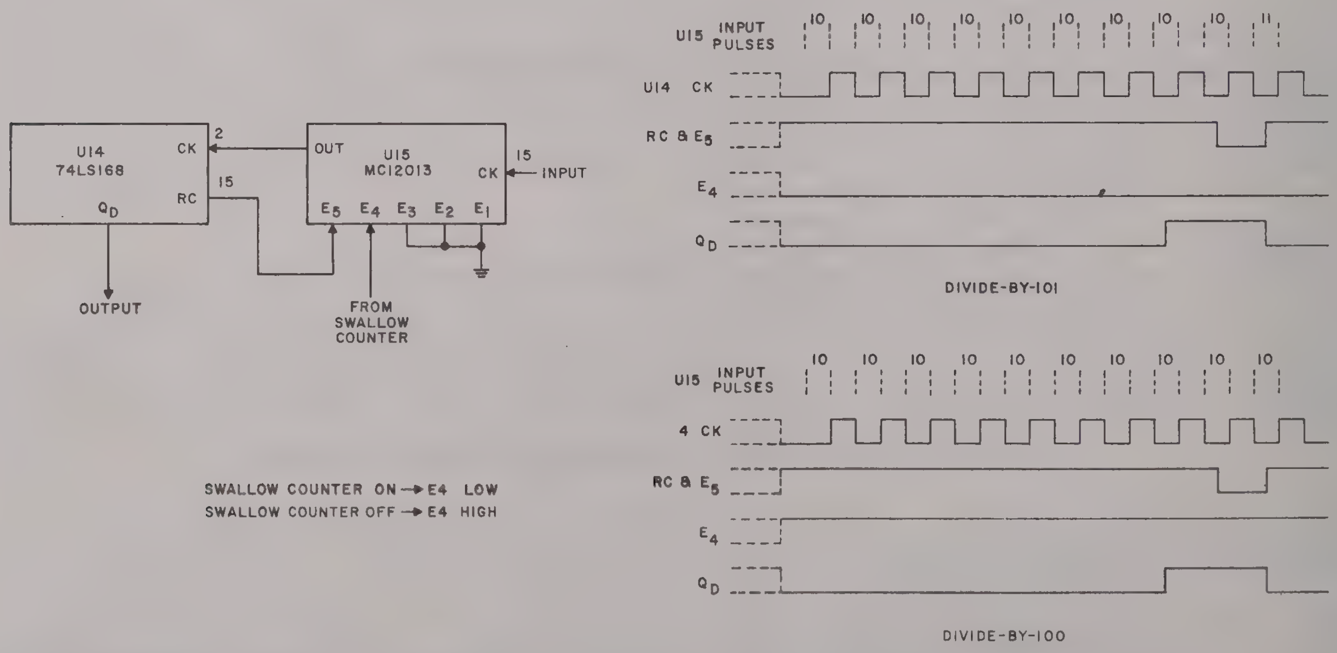

U14
74LS168
CK
RC
QD
2
15
OUT
U15
MC12013
CK
15
INPUT
E5 E4 E3 E2 E1
OUTPUT
FROM SWALLOW COUNTER
SWALLOW COUNTER ON → E4 LOW
SWALLOW COUNTER OFF → E4 HIGH
U15 INPUT PULSES
10 10 10 10 10 10 10 10 10 11
U14 CK
RC & E5
E4
QD
DIVIDE-BY-101
U15 INPUT PULSES
10 10 10 10 10 10 10 10 10 10
4 CK
RC & E5
E4
QD
DIVIDE-BY-100

Figure 3-15. 2nd LO Prescaler Timing Diagram

The swallow counter is comprised of U7 (a decade counter) and U8 (a binary counter). U11A, B, and C form the swallow counter detector. The counter can be loaded with any number between 00 and 99, inclusive. During a load pulse U7 and U8 are loaded and the output of the NAND latch formed by U11B and U11C is reset. This low signal is sent to the prescaler control input of U15, causing it to divide by 101. When U8 reaches state 1010, sensed by U11A, the NAND latch will be set causing the prescaler to divide by 100. As soon as U8 is clocked to state 1010, U7 will be in 0000 state because up counting is used. Since detection occurs when U7 is 0 and U8 is 10, the terminal count for the swallow counter is 100.

The programmable counter consists of binary counters U9 and U10. U11D is used as the detector. U9 can be loaded with any value between 0 and 9, and U10 is always loaded with 2. Since binary counters are used, the 2 loaded in the second digit is not worth 20 (2x10), but is worth 32 (2x16). U11D senses a high level on the QA output of U9 and the minimum/maximum output of U10. The first time this occurs while up counting is when U10 and U9 are in states 15 and 1, respectively. Again the 15 in the second digit is worth 240 (15x16), so the terminal count is 240 + 1 = 241. Each count of the programmable counter is equal to 100 counts of the overall divide chain so the actual terminal count for the programmable counter is 241 x 100 = 24100.

Combining the terminal counts of both counters will yield the overall terminal count. The terminal count for the swallow counter was 100 and for the programmable counter was 24100. Therefore, the terminal count for the whole chain is 100 + 24100 = 24200. The programmable counter is always loaded with 32 plus the input to U9 so the overall chain is loaded with 3200 (32x100) plus the inputs to the three stages.

Suppose 000 is loaded into the 2nd LO. The input to the counters is 3200 + 000 = 3200. The terminal count is 24200 so the divide ratio is 24200 - 3200 = 21000. Suppose 999 is loaded. The input is 3200 + 999 = 4199. The divide ratio is 24200 - 4199 = 20001. Suppose 500 is loaded. The input is 3200 + 500 = 3700. The divide ratio is 24200 - 3700 = 20500.

Assuming lock is achieved, a 10 kHz signal should be seen at the output of U11D. This signal is compared to a 10 kHz reference frequency from the time base, in phase detector U12A, and filtered in U12B (these circuits are described in paragraph 3.3.2.4). The dc voltage from U12B varies the capacitance of varactor CR5 which varies the frequency of oscillator Q7. This signal, ranging from 200.01 MHz to 210.00 MHz feeds the prescaler and routes to a divide-by-1000 circuit. U16, U17, and U19 each are divide-by-10 counters. When cascaded, the circuit results in a division ratio of 1000 (10x10x10). The input to U6A is a signal ranging from 200.01 kHz to 210.00 kHz.

The 2nd LO output loop produces the 2nd LO frequency range of 32.20001 to 32.2100 MHz in 10 Hz steps. This range of frequencies and the 32 MHz signal from Q1 mixes in U4 resulting in a difference frequency range from 200.01 kHz to 210.00 kHz.

Differential amplifier U5 accepts the push-pull input from U4 and amplifies the signal approximately 10 times into a single-ended output. Q2 translates the output level of U5 to TTL levels for the input to U6A. This signal and the phase locked frequency from the programmable divider are compared in phase detector U6A, producing dc voltages that are filtered by U6B (these circuits are described in paragraph 3.3.2.4). U6B's output varies the capacitance of varactor diode CR4 and tunes oscillator Q6. This output enters a buffer amplifier, Q3, where the signal connects to mixer U4 and filtered by C22 and C23 to become the 2nd LO output.

3.3.7 TYPE 791600 1ST LO SYNTHESIZER (A5A1A2)

The 1st LO Frequency Synthesizer circuits are part of the 1st and 3rd LO, Time Base circuit board. The 1st LO utilizes a phase lock loop configuration with the prescaling technique previously described in paragraph 3.3.2.3. The output of the 1st LO tunes in 10 kHz steps from 42.91 MHz to 72.90 MHz. This tuning range coincides with the 0.0 to 29.99 MHz receiver tuning range to produce a 1st IF signal of 42.90 to 42.91 MHz. A block diagram of the 1st LO is shown in Figure 3-16.

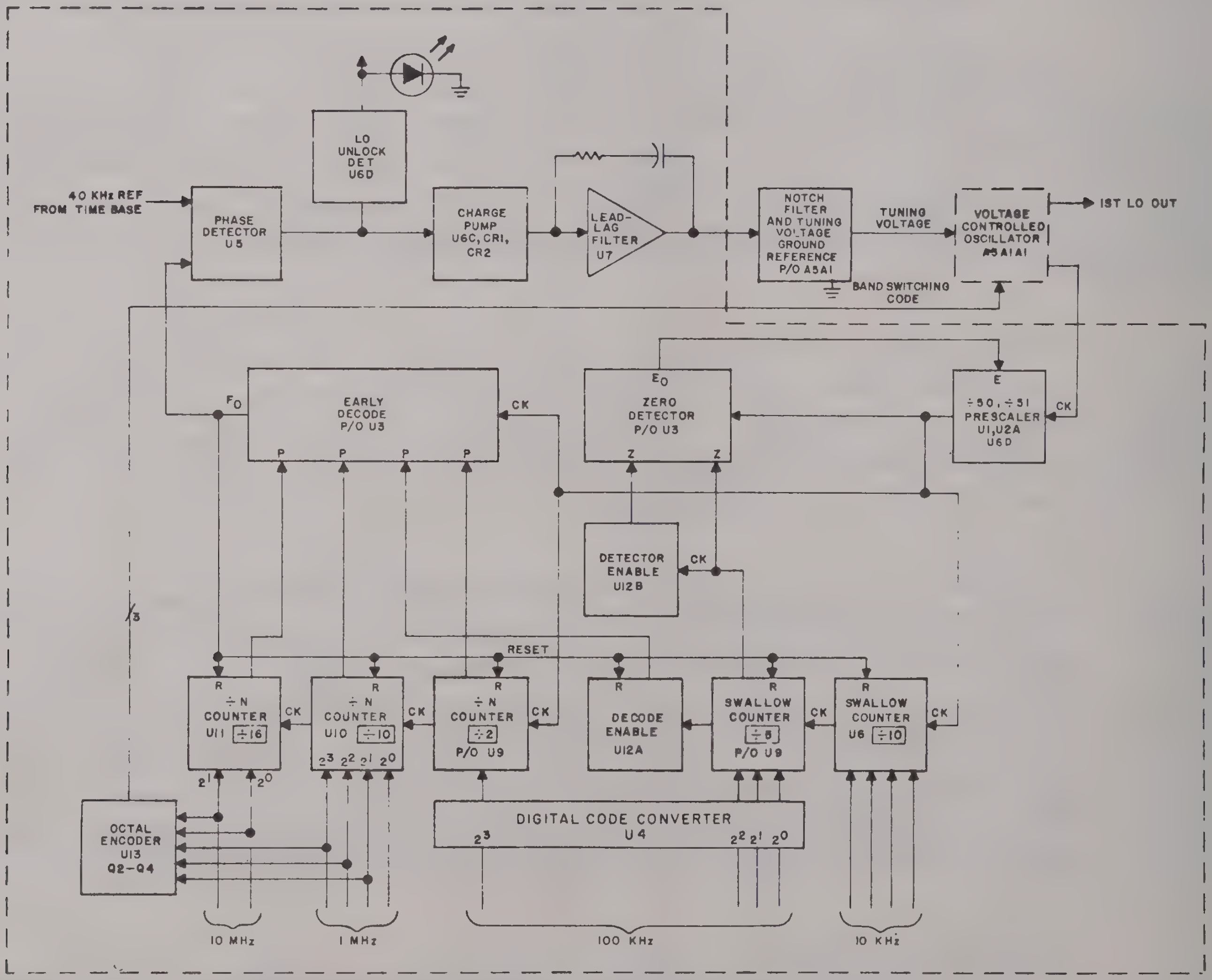

40 KHz REF FROM TIME BASE
PHASE DETECTOR U5
LO UNLOCK DET U6D
CHARGE PUMP U6C, CR1, CR2
LEAD-LAG FILTER U7
NOTCH FILTER AND TUNING VOLTAGE GROUND REFERENCE P/O A5A1
TUNING VOLTAGE
VOLTAGE CONTROLLED OSCILLATOR A5A1A1
1ST LO OUT
BAND SWITCHING CODE
F0
EARLY DECODE P/O U3
P
P
P
P
CK
E0
ZERO DETECTOR P/O U3
Z
Z
E
÷50, ÷51 PRESCALER U1,U2A U6D
CK
DETECTOR ENABLE U12B
CK
3
RESET
R
÷ N COUNTER U11 ÷16
CK
R
÷ N COUNTER U10 ÷10
CK
2³ 2² 2¹ 2⁰
R
÷ N COUNTER ÷2 P/O U9
CK
R
DECODE ENABLE U12A
R
SWALLOW COUNTER ÷5 P/O U9
CK
R
SWALLOW COUNTER U6 ÷10
CK
2¹
2⁰
OCTAL ENCODER U13 Q2-Q4
DIGITAL CODE CONVERTER U4
2³
2² 2¹ 2⁰
10 MHz
1 MHz
100 KHz
10 KHz

Figure 3-16. 1st LO Functional Block Diagram

3.3.7.1 Functional Description

The programmable divider, phase detector, and lead-lag filter of the 1st LO Synthesizer are contained on the main circuit board (Type 791600); the VCO and tuning voltage control circuits are mounted separately but together with the main circuit board form a combined assembly. The phase detector (U5), charge pump (U6C), and lead-lag filter (U7) of the 1st LO will be discussed lightly since a detailed description of these circuits can be found in paragraph 3.3.2.4 of the Phase Lock Loop Section. Refer to Figure 3-16 for the following discussion.

A two-modulus prescaler (described in paragraph 3.3.2.3) is used at the input to the divide-by-N counter to divide down the frequency from the VCO so that it can be handled by conventional low-power Schottky counters. If the 1st LO is locked on the correct frequency, the output of the programmable counter will be 40 kHz. This 40 kHz is compared to the 40 kHz reference frequency from the Time Base in phase detector U5. The difference in frequency and phase of these two input signals produces a series of pulses which the charge pump converts to positive or negative going voltages. These voltages are integrated by lead-lag filter U7 to provide the tuning voltage for the VCO. The Notch Filter and Tuning Voltage ground reference circuits isolate the VCO tuning voltage from any ripple from the 40 kHz reference frequency. An octal band switching code, generated by octal encoder U13 from the divider section, switches the VCO to one of eight tuning ranges spaced 16 MHz apart.

The VCO has two inputs and two outputs. The inputs to the VCO are a tuning voltage and a band switching code. Together they supply the VCO with the necessary information for tuning to the correct frequency. The actual VCO generates frequencies between 171.64 MHz and 291.60 MHz. This range is sent to the programmable divider of the phase lock loop. The other output of the VCO is the 1st LO output. Since the 1st LO frequency range needs to be from 42.91 MHz to 72.90 MHz, the VCO frequency range must be divided by 4. For this same reason, the eight tuning ranges of the VCO (from the band switching code) are spaced 16 MHz apart within the VCO and 4 MHz apart (16 MHz ÷ 4) for the 1st LO output. In summary, the VCO frequency is four times that of the 1st LO frequency.

The programmable divider has an input range from 171.64 MHz to 291.60 MHz in 40 kHz steps and must divide each of these frequencies down to exactly 40 kHz. This condition calls for the programmable divider to have a divide ratio from 4291 (171.60 ÷40 kHz) to 7290 (291.60 MHz ÷ 40 kHz).

From the conditions above, the counters within the programmable divider, U8, U9, U10 and U11, must have a divide range from 4291 to 7290. The inputs of the counters are always preset with the BCD equivalents of the four most significant digits of the tuned frequency. This range is from 0000 to 2999. For example, if the tuned frequency desired is 29.87000 MHz, U11 would be preset with a 2, U10 preset with a 9, U9 preset with an 8, and U8 preset with a 7. One other condition exists at the input to the counters; U11 is wired to automatically add 8 to its preset. Therefore, the counter presets have a range from 8000 to 10999. The external circuits connected to the counters (see Figure 3-16) stop the counters from counting when they reach the number 3709. Since the counters are wired to count down, the overall divide range needed from the counters is accomplished; the divide range is from 4291 (8000-3709) to 7290 (10999-3709).

3.3.7.2 Circuit Description

3.3.7.2.1 Counting Cycle

Although the counters have the correct divide range needed to divide the input frequency down to 40 kHz, the VCO output frequency is too high for the counters to operate properly. Therefore, a high-speed, two-modulus prescaler is used to divide the input frequency to a range that can be handled by the counters.

The prescaler used in the 1st LO divides either by 50 or 51. In order for the counters to divide correctly, they must divide in increments of 50 or 51 also. A problem that exists is that when the prescaler divides by either 50 or 51, only one pulse is sent to the counters. Therefore, the counters must interpret this pulse as representing either 50 input pulses or 51 input pulses.

The counter section shown in Figure 3-16 is divided into two parts: a programmable counter and a swallow counter. The programmable counter consists of U9, U10 and U11, and the swallow counter consists of U6 and U9. Both counters receive the same clock pulse from the prescaler output. Each count of the programmable counter represents 50 clock pulses from the VCO. Each count of the swallow counter represents the extra pulse which occurs when the prescaler divides by 51. By having the swallow counter control the prescaler, the represented count will decrement by 51 when the programmable counter and the swallow counter are counting. When the swallow counter reaches terminal count, the prescaler will begin to divide by 50.

Figure 3-17 shows graphically a typical 1st LO counting cycle. The prescaler divides by 51 until the swallow counter reaches terminal count. When the outputs of the swallow counter reach this state, they cause the zero detector's Eo output state to become high. This causes the prescaler to divide by 50 until the end of the count cycle. Since the programmable counter is separately clocked, it continues to count down until its terminal count is detected by the early decode circuit. When this occurs, the Fo output of the early decode goes high after the next clock pulse from the prescaler. When the output from the early decode circuit again goes low, it resets the counters to the preset number on their inputs. It also causes the reset enable circuit to reset the zero detector circuit causing its output to go low so the prescaler can divide by 51 during the next count cycle.

Refer to the schematic diagram of the 1st LO, Figure 6-16, to aid in understanding the circuit descriptions presented below.

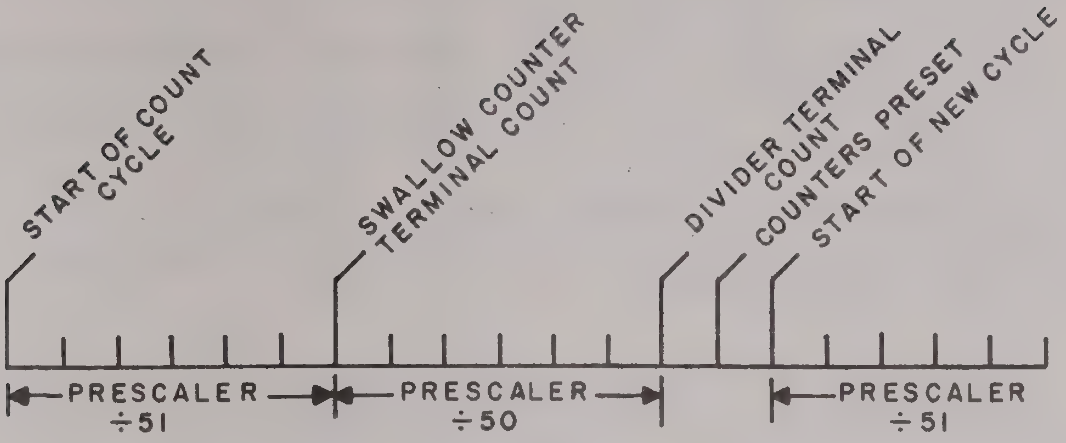

START OF COUNT CYCLE
SWALLOW COUNTER TERMINAL COUNT
DIVIDER TERMINAL COUNT
COUNTERS PRESET
START OF NEW CYCLE
PRESCALER ÷51
PRESCALER ÷50
PRESCALER ÷51

Figure 3-17. 1st LO Counting Cycle

3.3.7.2.2 Prescaler, U1 and U2A

The prescaler input frequency ranges from 171.64 MHz to 291.60 MHz. The prescaler divides this by 50 or 51, depending on the states of the E inputs of U1. Figure 3-18 illustrates the prescaler's operation. U1 is a divide-by-10/11 counter and U2A is a divide-by-5 counter. The prescaler divides by 51 when E4 is low and when E5 pulses low once for every five pulses from U2A. E5 is low for only one count out of five so the complete count cycle of U1 and U2A takes 51 counts 4 x 10 + 1 x 11. This count cycle continues until the swallow counter reaches terminal count. E4 then goes high and U1 divides by 10 only, giving U1 and U2A a complete count cycle of 50.

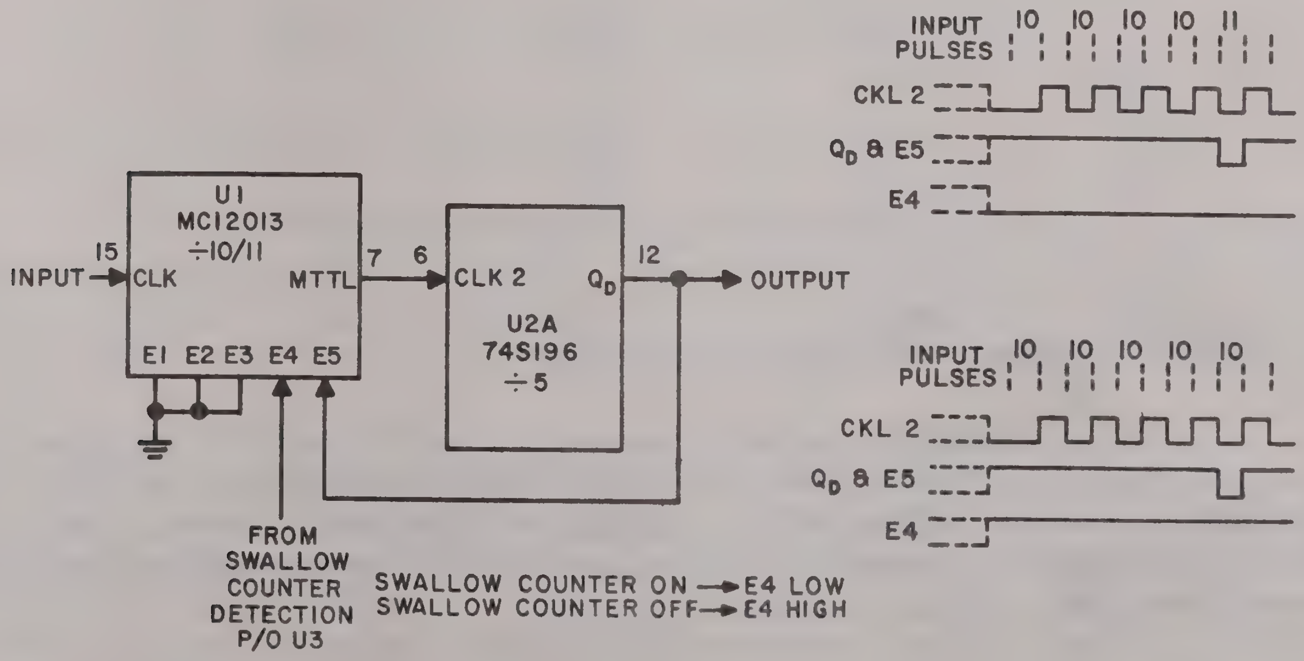

INPUT PULSES
10 10 10 10 11
CKL 2
Q_D & E5
E4
U1
MC12013
÷10/11
15
INPUT
CLK
MTTL
E1 E2 E3 E4 E5
7
6
CLK 2
Q_D
12
OUTPUT
U2A
74S196
÷5
INPUT PULSES
10 10 10 10 10
CKL 2
Q_D & E5
E4
FROM SWALLOW COUNTER DETECTION P/O U3
SWALLOW COUNTER ON → E4 LOW
SWALLOW COUNTER OFF → E4 HIGH

Figure 3-18. 1st LO Prescaler Timing Diagram

3.3.7.2.3 Digital Code Converter U4

U4 serves as a decoder or code converter. It behaves as a look-up table or Read Only Memory (ROM) to translate a BCD input, which has bit values of 23, 22, 21, 20, to a new code with bit values of 51, 22, 21, 20. Table 3-6 illustrates all possible inputs and outputs of U4. For BCD input corresponding to decimal 0 through 4, the output bits Y1 through Y4 are the same as the output. For decimal inputs 5 through 9, Y4 becomes 1 and Y1, Y2, and Y3 correspond to the binary code for the decimal input minus 5.

U4 serves as part of the programmable counter and part of the swallow counter. Y4 controls the divide-by-2 counter which is part of the programmable counter. Y1, Y2 and Y3 controls the divide-by-5 counter which is part of the swallow counter. The function of U4 in each counter section will be discussed below.

Table 3-6. Digital Code Converter, U4, Truth Table

INPUTS (BCD)				OUTPUTS			
2^3 D	2^2 C	2^1 B	2^0 A	5^1 Y4	2^2 Y3	2^1 Y2	2^0 Y1
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	0
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0

3.3.7.2.4 Programmable Counter U9, U10, U11

The programmable counter consists of U9, U10 and U11. All three counters count down. U10 is a divide-by-10 counter (BCD). U11 is a divide-by-16 counter (BINARY). With the D input of U11 tied high (to Vcc3), the counter is always preset with at least 8 (1000). The divide-by-2 counter within U9 is used by the programmable counter using preset input D0 and output Q0.

U11, U10 and U9 are cascaded with a clock input entering U9 at pin 6 (CLK1). U9 cascades to U10 and clocks U10 on the 0 to 1 transition. U10 cascades to U11. The programmable counter counts from its preset values on U11, U10 and U9 down to a detection number of 370 (0011, 0111, 0000). A carry condition is the only exception to this count sequence and will be discussed later.

3.3.7.2.5 Swallow Counter U8 and U9

The swallow counter is hardwired for down counting and consists of U8 and part of U9. With U8 being a divide-by-10 (BCD) counter and the part of U9 being a divide-by-5 counter, the swallow counter has a preset input range from (decimal) 00 to 49. The clock input for the swallow counter enters U8 at pin 14 decrementing U8 and (cascaded) U9. The swallow counter can be preset from 00 to 49. Referring to Figure 3-19, it is seen that a 40 to 39 transition must occur before terminal count at 09 is valid. Therefore, with preset inputs between 00 and 39 (inclusive), the swallow counter cycles past the first 09 to a 40 to 39 transition, then terminates count at 09.

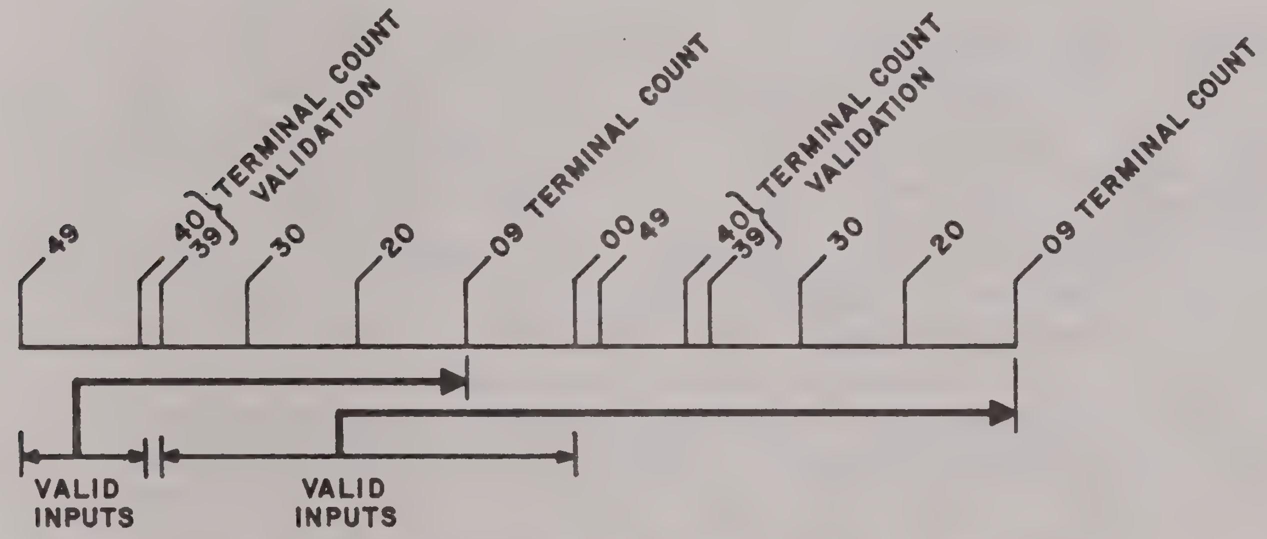


Figure 3-19. Swallow Counter Detection Sequence

3.3.7.2.6 Carry Condition U12A and U6A

A carry condition occurs in the programmable counter for any inputs to the swallow counter between 00 and 39. For these inputs, the programmable counter detection number is changed from 370 to 371. Detection occurs when a 3 (0011) is at the outputs of U11, a 7 (0111) at the outputs of U10, and a 1 at the Q0 output of U9.

The carry condition is controlled by U12A and U6A. At the beginning of any count cycle, the output of U12A is high. This condition places a high at pin 1 of U6A so that the output of U6A depends on its pin 2 input. P1 of U3 will be activated when the Q0 output of U9 is low. However, if U12A gets clocked, pin 2 of U6A will be low and the output of U6A will always be high. With this condition, detection will occur when Q0 of U9 has a 0 to 1 transition. In conclusion, terminal count of the programmable counter is 3750 when a carry condition exists and 3700 when it does not.

3.3.7.2.7 Divider Section Terminal Count

The terminal count of the divider section is determined by the inputs of the control chip U3, flip-flop U12A and U12B, and NAND gate U6A. U3 is comprised of two parts: the swallow counter detector and the programmable counter detector. The swallow counter detector uses the Z inputs of U3, flip-flop U12A, and NAND gate U6A to determine terminal count. The programmable counter uses the P and B inputs of U3 to determine its terminal count.

Because of the relatively high counting speed, the counters need more than one clock pulse to be reset. Therefore, a two-clock pulse look ahead is required by the programmable counter detector and is shown in Figure 3-20. Although the actual number that wants to be detected is 3750 (or 3700), the actual number the circuits are detecting is 3850 (or 3800).

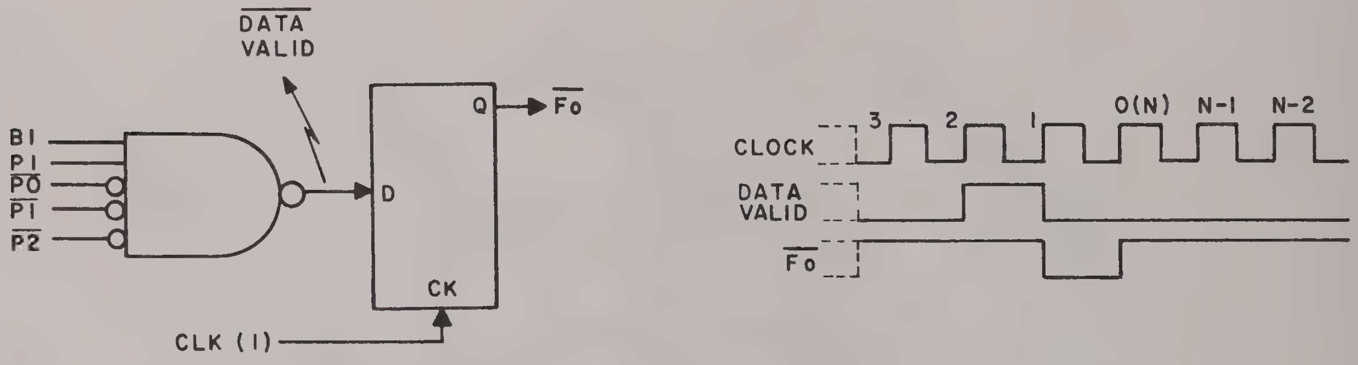


Figure 3-20. Two-Pulse Look Ahead, Count Termination

To find the overall terminal count, both detectors must be combined. The swallow counter detects terminal count at 09 and the programmable counter detects terminal count at 3700 (the carry condition occurs only to supplement the differences in the counting cycle). Therefore, the combined terminal count number for the divider section is 3709.

This example will illustrate the counting sequence. Suppose all zeros are input into the 1st LO. Since an 8 (1000) is always added to the most significant digit, the counters are loaded with 8000. The terminal count is 3709 so the division ratio is 8000 - 3709 = 4291.

The reference frequency is 40 kHz, giving the VCO a frequency of 4291 x 40 kHz = 171.64 MHz. Since the 1st LO output is one-fourth the VCO frequency, the 1st LO output is 171.64 MHz ÷ 4 = 42.91 MHz.

3.3.7.3 VCO Band Select Code

The VCO Band Select circuits are shown in the middle of the 1st and 3rd LO Synthesizer Schematic Diagram, Figure 6-14. The purpose of U13, Q2, Q3, and

Q4 is to translate the 1st LO frequency range into eight different frequencies for the VCO. The band select code causes different combinations of inductance to be placed across the VCO tuning circuitry, thereby changing the VCO frequency range.

Octal encoder U13 accepts BCD inputs from the two most significant digits of the 1st LO frequency word and translates them into a binary coded word on Y2, Y3, and Y4. The transistors connected to these outputs supply negative true-code outputs. For example, when Y2 is low, -12 V appears at the base and emitter of Q2 turning the transistor off. This causes the collector to be off and +15 V to appear at output E1. When Y2 is high, Zener diode CR8 conducts causing Q2 to turn on, resulting in a -12 V potential at output E1.

3.3.8 TYPE 791629 VOLTAGE CONTROLLED OSCILLATOR (A5A1A1)

3.3.8.1 Functional Description

Figure 3-21 is the functional block diagram for the Voltage Controlled Oscillator. The VCO is an integral part of the 1st LO Synthesizer loop whose inputs are a tuning voltage and a band select code and whose output is the 1st LO frequency. The VCO operates at a frequency four times the desired 1st LO frequency. The band select code and the tuning voltage combine to tune the oscillator from 171.64 MHz to 291.60 MHz in 40 kHz steps. The oscillator output is amplified by Q2 and divided by a power splitter between the Buffer Amplifier and the Divide-by-4 Assembly. Buffer Amplifier Q3 provides the synthesizer with a sample of the oscillator signal. The sample is processed and, if required, a slight correction is made to the tuning voltage. The amplified oscillator frequency is divided by 4 (by U1) since the oscillator frequency is actually four times the desired 1st LO frequency. Amplifier Q7 supplies a high-level signal for the 1st mixer. A further explanation of the VCO follows.

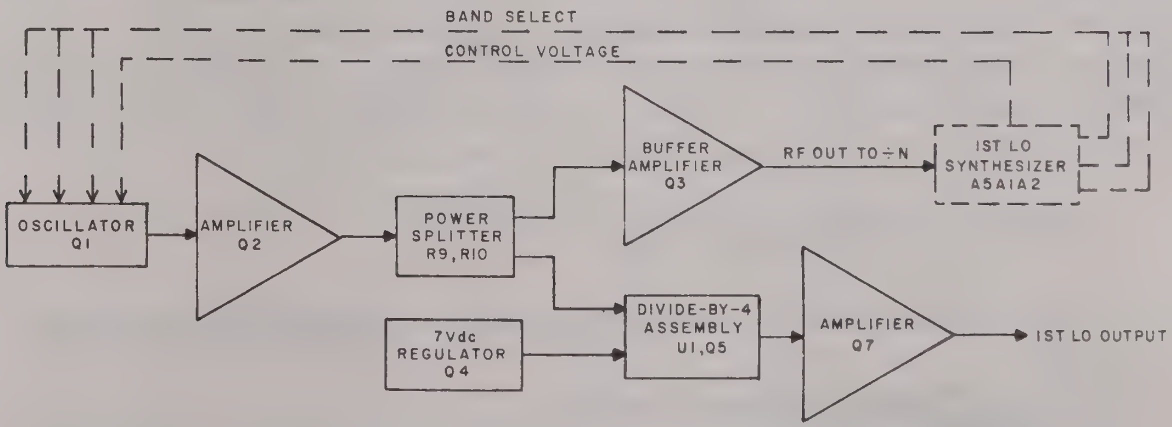


Figure 3-21. VCO Functional Block Diagram

3.3.8.2 Circuit Description

Refer to Figure 6-15 for the schematic diagram of this circuit. This description follows the same organization as the functional description given in the preceding paragraph.

Applying a negative-true-code voltage to the BAND SELECT inputs tunes the oscillator to one of eight different frequency bands. When the BAND SELECT inputs are all positive, CR1 through CR3 are off, and L2 through L4 are effectively out of the circuit. This allows the inductance of T1 to be maximum. When any or all of the BAND SELECT inputs are negative the corresponding diode will conduct and the inductance of T1 will be reduced by the shunting effect of the inductor (L2, L3, or L4). Varactor diode CR4 fine tunes the oscillator in response to the tuning voltage input. Common-emitter amplifier Q2 keeps load changes at the input of power divider R9 and R10 from being reflected back to the output of oscillator Q1. T2 matches the output of the amplifier to the input of the power divider. The signal is coupled to buffer amplifier Q3, which drives the prescaler of the synthesizer. R9 and C15 couple the signal from Q2 to the input of the divide-by-4 circuit U1. MECL divider U1 divides the signal frequency by four and amplifier Q5 isolates its output from load changes. Voltage Regulator Q4 provides U1 and Q5 with a -7.0 V power input from the -12 V power supply input to the assembly. Amplifiers Q5 and Q7 provide the relatively high currents needed to drive the input of the first mixer.

3.3.9 TYPE 791630 1ST AND 3RD LO SYNTHESIZER/TIME BASE (A5A1)

This assembly is located in the right-hand side of the receiver and connects the 1st and 3rd LO/Time Base circuit board to the 1st LO VCO circuit board. The connections include three lines for the VCO band select code, two lines for the VCO tuning voltage, and one line connecting the VCO output to the 1st LO divider section. Also on this board is a -12 Vdc regulator that supplies voltage to both the 1st LO Synthesizer and the 1st LO VCO.

The schematic diagram corresponding to this circuit board is shown in Figure 6-13. The tuning voltage connects to the VCO through a 40 kHz trap (C1, C3, L1, L2, and L3) and a low-pass filter (C4, C6, C8, R4, and L4). CR1, CR2 and CR3 provide a 1.8 V potential on the tuning voltage reference line. A -15 Vdc potential from the 1st LO circuit board enters pin 3 of the voltage regulator VR1 and is regulated to a -12 Vdc output on pin 2. The -12 Vdc is supplied to the VCO, to power its circuits, and to the 1st LO synthesizer to power lead-lag filter U7.

3.4 DIGITAL CONTROL SECTION

The digital control section is composed of the following circuits:

Manual Tuning Up/Down Counter
Front Panel Interface
Manual Tuning Module (optional)
Frequency Display
BFO Switch
Upper Panel Control
Lower Panel Control

Figure 3-22 shows the relationship of these circuits to each other. An explanation of each circuits operation follows.

3.4.1 TYPE 791575 MANUAL TUNING UP/DOWN COUNTER (A6A1)

The Manual Tuning Up/Down Counter contains the LO frequency data. This information is sent to the 1st and 2nd LO Synthesizers and is encoded for multiplexing to the display board. The frequency word can be changed in two ways: from the Manual Tuning Module via front panel control, or from the Remote Input Jack by an external controller. A block diagram of the Up/Down Counter is shown is Figure 3-23. The functions of the Up/Down counters and the multiplexer are presented below followed by an overall circuit description.

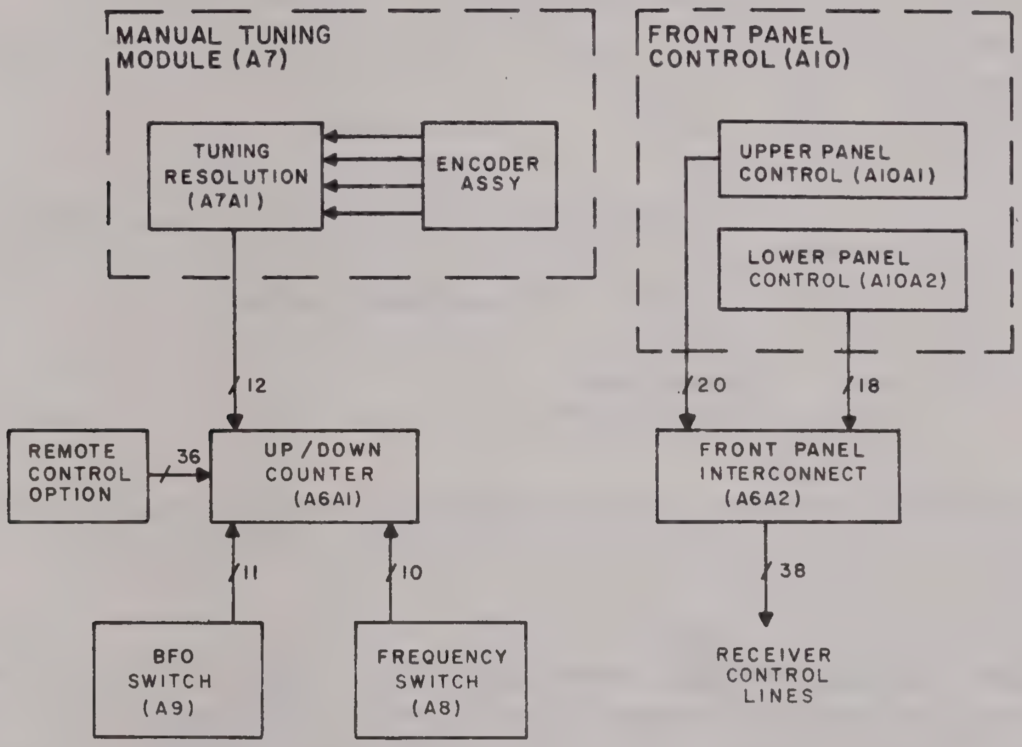

MANUAL TUNING MODULE (A7)
TUNING RESOLUTION (A7A1)
ENCODER ASSY
FRONT PANEL CONTROL (A10)
UPPER PANEL CONTROL (A10A1)
LOWER PANEL CONTROL (A10A2)
12
20
18
REMOTE CONTROL OPTION
36
UP/DOWN COUNTER (A6A1)
FRONT PANEL INTERCONNECT (A6A2)
11
10
38
BFO SWITCH (A9)
FREQUENCY SWITCH (A8)
RECEIVER CONTROL LINES

Figure 3-22. Digital Section Functional Block Diagram

3.4.1.1 Integrated Circuit Data

The 14510 is a presettable Up/Down decade counter and is shown in Figure 3-24. Pin 15 is the clock input. The counter will increment for each rising edge of the clock when the up/down input (pin 10) is high; when pin 10 is low, the counter will decrement. If the parallel enable input (pin 1) is high, clocking is inhibited and the information on the P inputs are transferred to the corresponding Q outputs. Cascading of counters is accomplished by tying the carry input (pin 5) of one counter to the carry output (pin 2) of the preceding counter and by connecting the control inputs (clock, up/down, parallel enable) in parallel. If the carry input is high, the counter is inhibited from clocking. The carry output, normally high, goes low during a carry condition. Carry conditions occur when the counter is in a 0 state during down counting or when the counter is in a 9 state during upcounting. Therefore, any stage in a counter chain will clock only when all preceding stages are at terminal count.

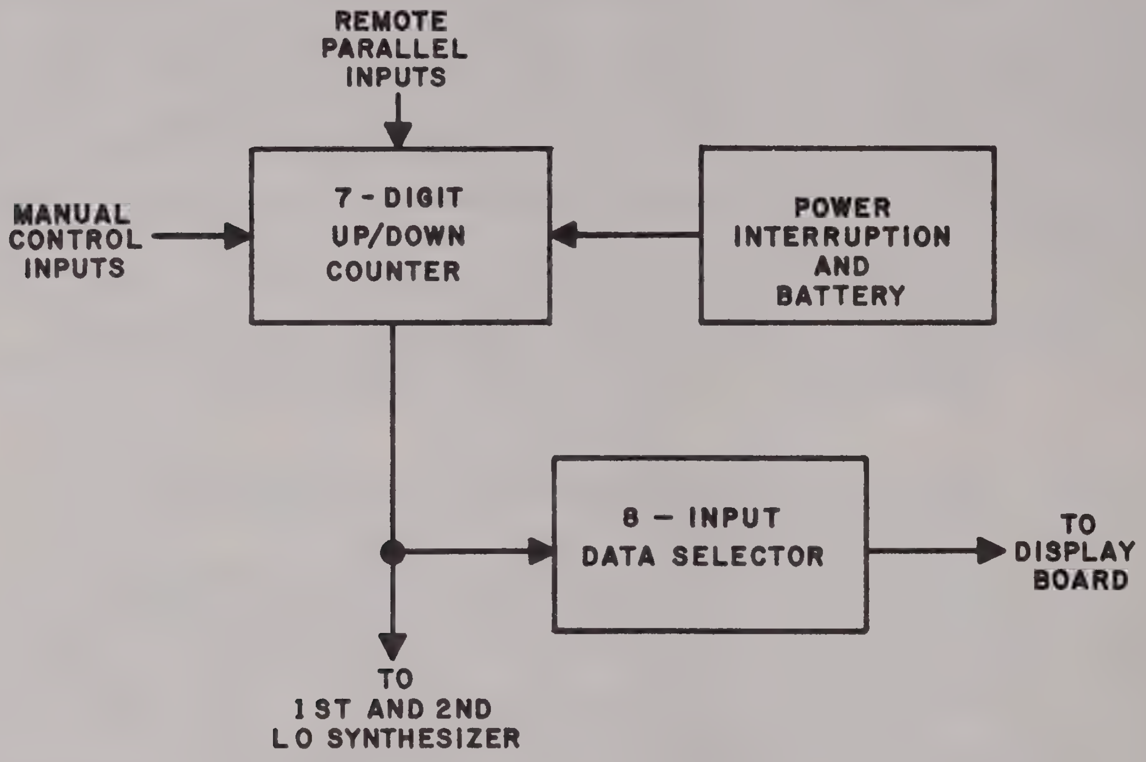

REMOTE PARALLEL INPUTS
MANUAL CONTROL INPUTS
7-DIGIT UP/DOWN COUNTER
POWER INTERRUPTION AND BATTERY
8 – INPUT DATA SELECTOR
TO DISPLAY BOARD
TO 1ST AND 2ND LO SYNTHESIZER

Figure 3-23. Manual Tuning Up/Down Counter Block Diagram

The 14512 is an eight input data selector and is shown in Figure 3-24. Control inputs A, B, and C select which of the data inputs, X0 to X7, is gated to output Z. The data input selected is determined by the binary equivalent of the control inputs. When activated, the disable line will force a low on the Z output and the inhibit input will cause it to go to the high impedance state.

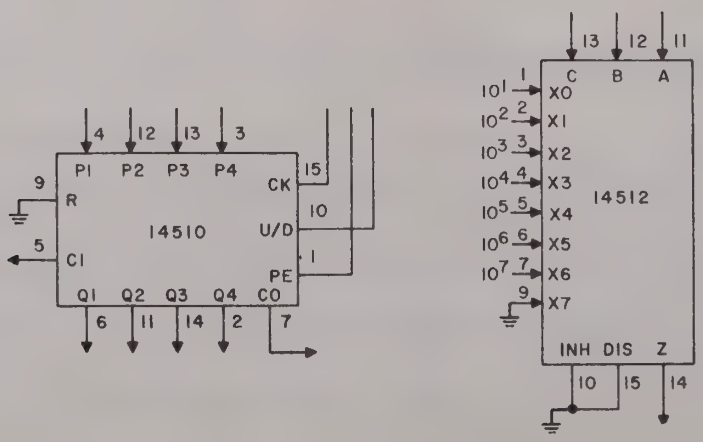

4
12
13
3
P1
P2
P3
P4
9
R
CK
15
10
U/D
14510
5
CI
1
PE
Q1
Q2
Q3
Q4
CO
6
11
14
2
7
13
12
11
C
B
A
10¹ 1 X0
10² 2 X1
10³ 3 X2
10⁴ 4 X3
10⁵ 5 X4
10⁶ 6 X5
10⁷ 7 X6
9 X7
14512
INH
DIS
Z
10
15
14

Figure 3-24. Up/Down Counter Integrated Circuit Data

3.4.1.2 Circuit Description

The schematic diagram for this circuit is shown in Figure 6-18. The Up/Down counter is comprised of U2 to U11. U2 to U7 are MC14510's cascaded to form a six-digit presettable up/down decade counter. U1F, U8C, U9, U10 and U11 form the last stage of the counter. U9 is a dual JK flip-flop. U1F, U8C, U18B, U10B and U10D form the logic to control the states of U9. During an up count U9 will clock from 0 to 2 and then back to 0 again. Down counting will produce states in the opposite direction. U11, U10C and U10A form this logic to preset flip-flop U9. With the load line low, the outputs of U11 will all be low, having no effect on U9. If the load line is high, U9A will reset if the 2^0 of the 10^7 input is high and clear if it is low; U9B will reset if 2^1 of 10^7 is high and clear if it is low. U8A, U8B and U8D are used to gate the carry outputs of the first three stages to be used for the tuning resolution select. The tuning resolution switches provide a short to the step select switch output (normally low) for the activated switch and an open circuit for the switches not chosen. Resistors R5 to R8 are pull-up resistors to provide a high level on the open circuited lines. If the 10^1 switch is selected, counter U2 will be enabled. Since the other lines will all be high, all AND gates will be enabled. The resultant is a normal seven decade counter. If the 10^2 step select is chosen, AND gate U8D will be disabled. U2 will be inhibited since its carry input will be high. Since the carry input of U3 is now always low, it will clock for each pulse received on its clock input. U8B and U8D will still be enabled allowing for normal carry operation. The counter now behaves as though counter U2 is no longer in the circuit. If the 10^3 select is chosen both U2 and U3 are disabled; if the 10^4 is chosen, U2, U3 and U9 are inhibited.

The clock and direction signals are from the Manual Tuning Module. When up counting is desired, the clock line lags the direction line by 90°; when down counting is desired, it leads by 90°. U1A and U1E are Schmitt triggers to buffer the input signals. Since both clock and direction lines are inverted, the relative sense between the two signals is maintained. During up counting, the rising edge of the clock will always occur when the direction line is high, causing the counter to increment. In down counting, the rising edge will always occur when the direction line is low, decrementing the counter.

The P inputs of the counter are connected to the remote input jack. When the lead line is pulsed high, the levels on the P lines will be transfered to the outputs of the counter. When the load line returns low the counter will resume clocking from the new data. The remote input jack also contains lines from the IF bandwidth select. This allows remote control/monitor of the IF BW.

The LO frequency information is sent to the 1st and 2nd LO via the I/O and synthesizer motherboards. It is also sent to multiplexers U12 to U15. U12 receives the 2^0 bit of each digit, U13 receives the 2^1 bit, U19 receives the 2^2 bit, and U15 receives the 2^3 bit. The control inputs out U12 to U15 are all tied in parallel and feed to a binary counter U16. This counter is continuously clocked from an oscillator generated by U1C, U1B, C2 and R14. The frequency of oscillation is 2.3 kHz.

The outputs of U16 are also sent to J2 for decoding on the display board. The outputs of U12 to U15 are buffered by gates in U17D.

Operation of the data selector is as follows: when the counter U16 has all zeros on its outputs, the A, B, and C inputs of U12 to U15 will be low. This will gate all XO inputs to their respective Z outputs. The information sent to the display board via J2 will be:

$$Q_2Q_1Q_0 = 000$$

$$2^3 2^2 2^1 2^0 = 10^1 \text{ Digit}$$

When the oscillator clocks U16 again, the outputs will become a 001. This will cause the Z1 input of each multiplexer to appear at their respective Z output. As the counter U16 clocks again, all X inputs will be sent to the Z output in the code shown in Table 3-7.

Table 3-7. Data Selector 14512, Truth Table

Q_2	Q_1	Q_0	2^3 2^2 2^1 2^0
0	0	0	10^1 Digit
0	0	1	10^2 Digit
0	1	0	10^3 Digit
0	1	1	10^4 Digit
1	0	0	10^5 Digit
1	0	1	10^6 Digit
1	1	0	10^7 Digit
1	1	1	All Low

This information can now be decoded on the display board. The display board knows exactly what digit is present on the 2^3, 2^2, 2^1, and 2^0 lines by just looking at the Q_2, Q_1, Q_0 inputs.

During power down, the LO frequency is remembered by powering the up/down counter from BT1 (2.5 V). Diode CR1 is used to charge the Nicad battery when power is on and to isolate the battery from the rest of the receiver when power is down. It is a hot carrier diode, dropping only about 0.4 V when forward biased. When power is on, VDD is at 5 V, forward biasing the diode and charging the battery through R9. If power fails, VDD drops to 0 V and diode CR1 becomes reverse biased allowing battery current to flow only to the chips connected to VDD2.

The purpose of Q1 and its circuitry is to inhibit all counters when power down occurs. Without it, the counters could clock when power was again applied to the encoder assembly, causing the clock input to go from a low (during power down) to a high (during power up).

Transistor Q1 controls the Step Select Switch ground. When power is on, the 10 V across resistor divider R11 and R12 will turn Q1 on which will place a low on the step select common. If the 10 V line drops below 7 V, the base of Q1 will drop below 0.7 V, and the transistor will turn off placing a high on the step select common through resistor R10. This high will prevent any of the step select lines from going low. The step select button chosen will short to a high level now, not a low, and the unchosen switches will still be pulled high by resistors R5 - R8.

3.4.2 TYPE 791828 FRONT PANEL INTERCONNECT (A6A2)

The purpose of this module is to interpret information from the manually controlled front panel into control information for the receiver. The front panel information entering this module contains selectable detection mode, gain mode, meter mode, and IF bandwidth, in addition to headphone and RF gain levels. This information is then decoded for use primarily in the IF stages of the receiver. Two output lines from the Front Panel Interconnect, however, activate or deactivate the BFO. The schematic diagram for this module is contained in the main chassis schematic diagram, Figure 6-20.

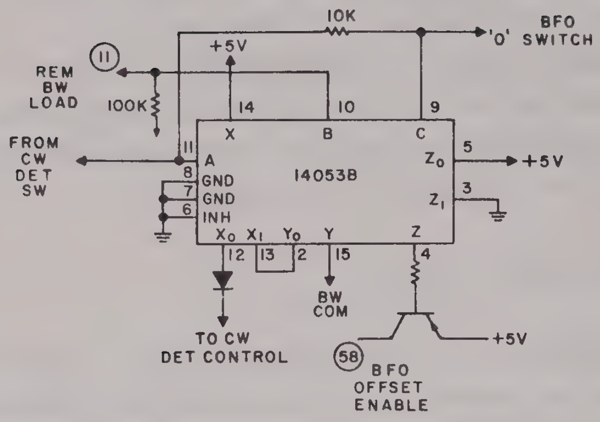
This circuit description will explain the operation of each manually-controlled input to this module and how it decodes and sends the information to the IF and BFO stages. The Front Panel Interconnect board incorporates an integrated circuit, U1, and will be discussed below.

As can be seen from the schematic, most of the lines from the front panel are simply passed through to the rest of the receiver. For these lines this module serves as a patch panel. For the IF bandwidth lines and certain detection mode lines diode logic is performed by CR1-3 and CR5-10 to control the combinations of IF filters as described in paragraph 3.2.1. Most of the remaining functions of this module relate to certain logic functions for the BFO synthesizer controlled by U1.

U1 is an analog multiplexer that effectively implements a double-pole triple-throw (DP3T) electronic switch. Referring to Figure 3-25, U1 incorporates control lines A, B, and C, common points X, Y, and Z, and switches X0, X1, Y0, Y1, Z0, Z1. Control lines A, B and C correlate to X, Y, and Z, respectively. As described in the truth table, when control line A is low, X connects internally to X0; when control line A is high, X connects internally to X1. Grounding the inhibit line enables all switches. U1 incorporates most of digital logic needed to interface the operator with the equipment.

3.4.3 TYPE 791617 MANUAL TUNING MODULE (A7) (OPTIONAL)

The manual tuning module controls the direction and rate of change of the tuned frequency. This module connects to the Manual Tuning Up/Down Count board (A6A1) and is mounted behind the receiver's front panel. The Manual Tuning Module consists of two parts: the encoder assembly and the tuning resolution switches. The schematic diagram of this module can be found in Figure 6-20.



CONTROL INPUTS			ON SWITCHES		
C	B	A			
0	0	0	Z0	Y0	X0
0	0	1	Z0	Y0	X1
0	1	0	Z0	Y1	X0
0	1	1	Z0	Y1	X1
1	0	0	Z1	Y0	X0
1	0	1	Z1	Y0	X1
1	1	0	Z1	Y1	X0
1	1	1	Z1	Y1	X1

Figure 3-25. Front Panel Interconnect Integrated Circuit Data

3.4.4 TYPE 791589 TUNING RESOLUTION (A7A1)

The tuning resolution switches select the desired tuning step to be used. The tuning steps are: 10 Hz, 100 Hz, 1 kHz, and 10 kHz. Switching is accomplished by connecting the desired tuning step to the step select switch line (+5 V) of the Manual Tuning Up/Down Count board (A6A1). The schematic diagram for this circuit is Figure 6-20.

When the 10 Hz button is depressed, E2 (10 Hz step line) connects to E16 (+5 V) and all digits are available for tuning. When the 100 Hz button is depressed, E10 (the 100 Hz step line) connects to E16 (+5 V). The 10 Hz digit is locked to the frequency indicated when the 100 Hz button was engaged while all other digits are available for tuning. When the 1 kHz button is depressed, E12 connects to E16, thus the five most significant digits of the readout can be varied by the tuning knobs. The two least significant digits will be locked to the frequency indicated when this button is engaged. When the 10 kHz button is selected, E8 connects to E16 and only the four most-significant digits of the readout can be varied by the tuning wheel. The 1 kHz, 100 Hz and 10 Hz digits will be locked to the frequency indicated when the 10 kHz button is engaged.

When the tuning disable button is engaged, the receiver locks to the frequency currently being displayed, any other tuning button will be released, and the tuning wheel disabled. In receivers with the remote control option, depressing the tuning button enables remote control operation.

3.4.5. ENCODER ASSEMBLY (A7U1)

This assembly converts tuning knob rotation to electrical inputs for the Manual Tuning Up/Down counter. When the tuning knob is turned, each of the two output lines from the encoder will swing repeatedly between approximately +5 V and 0 V. If the knob is rotated at constant speed, these two outputs will appear as trains of square waves. Due to the internal mechanics of the encoder, the transitions of these two wave trains will be staggered in time with respect to each other. When the knob is rotated clockwise to increase tuned frequency, the square wave on the direction line will appear to lead that on the clock line as in Figure 3-26. The action of the up/down counter depends on the level of its up/down input at the instant its clock line goes high. The level of the up/down input at any other time has no effect. Therefore, clockwise rotation causes the counter to count up and the tuned frequency to increase.

If the tuning knob is rotated counter-clockwise, the sequence of outputs is reversed; the direction square wave lags the clock square wave. In this case the direction line will be low when the clock line swings high causing the counter to count down, thus reducing the tuned frequency.

The two outputs of the encoder go through approximately 120 cycles per revolution of its input shaft. This causes a tuning step for roughly each 3° of knob rotation.

The encoder assembly uses infrared optics to accomplish its internal functions. It is not considered a repairable assembly.

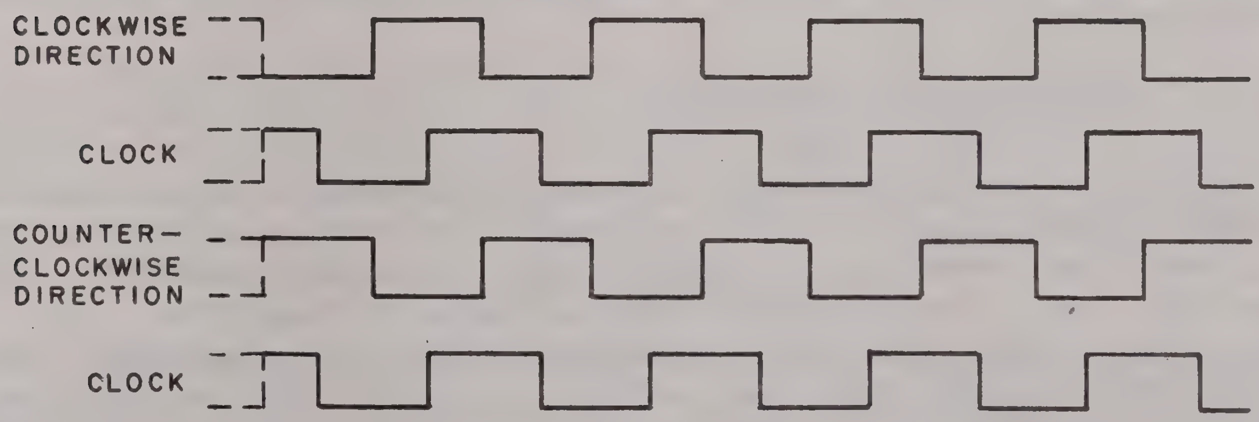


Figure 3-26. Encoder Assembly Timing Diagram

3.4.6 TYPE 791578 FREQUENCY DISPLAY (A8)

The frequency display accepts the multiplexed information from the Manual Tuning Up/Down Counter via connector J2 and displays it on the seven LED's on the front panel. The schematic diagram for this circuit is shown in Figure 6-19.

U1 to U7 are the seven segment common-cathode LED displays. All segments of each display are connected in parallel to the corresponding outputs of U8, a BCD to seven segment decoder/driver. U8 accepts a BCD word on its A, B, C and D inputs, converts it to a seven segment equivalent, and places the information on its A to G outputs. The outputs are internally current limited to provide about 50 mA so that external resistors are not needed. To turn a particular digit on, its common cathode input must be logic low. This selection is provided by U9, a binary to octal decoder. It accepts the Q0 to Q2 data on its A, B, and C inputs and places a high on the Q output where the value of the binary number is equivalent. U10 is a buffer inverter, capable of providing up to 500 mA of sink current.

Operation of the circuit is described below. The Up/Down Counter places display information into the A, B, and C inputs of U9. BCD information enters the A, B, C and D lines of U8. In U8, this information is decoded into a number and sent to all the LED's. U9 enables only one display at a time as commanded by its input information. Since the rate of change is 2 kHz, each digit is refreshed every 4 msec (2 kHz/8). This flicker rate is undetectable by the human eye.

Transistor Q1 is used for the intensity control. It is connected as a pass transistor from the unregulated 10 V to the supply voltage of U8. As the supply voltage of U8 is increased the current delivered to the LEDs will increase giving more intensity. R1, R2 and R4 are a resistor divider which bounds the emitter voltage of Q1 between about 4.5 V and 7 V.

The decimal point, CR1, is always on, receiving its current from Q1 through resistor R3.

3.4.7 TYPE 791588 BFO SWITCH (A9)

The BFO Switch schematic diagram can be found in Figure 6-20. Three thumbwheel switches provide a BFO variation of ±8.9 kHz from 455 kHz. The +, 0, -, thumbwheel provides the direction of offset, the second thumbwheel varies in range from 0 to 8, and the third thumbwheel varies in range from 0 to 9. A '0' setting of the direction thumbwheel causes the BFO to return automatically to 455 kHz (regardless of the other thumbwheel settings). The truth table for these switches are given in Table 3-8.

3.4.8 TYPE 791684 FRONT PANEL CONTROL (A10)

The Front Panel Control consists of the upper and lower panel control boards joined by a 40-pin ribbon connector. This connector is attached to the Front Panel Interconnect (A6A2) and controls the manual selection of detection mode, gain mode, meter mode, IF bandwidth, RF gain and headphone levels. Signals for the phone outputs also connect to the lower panel control through the Front Panel Interconnect.

Table 3-8. BFO Switch Truth Tables

NUMERIC DIGIT	OUTPUT				SIGN DIGIT	OUTPUT		
	2^3	2^2	2^1	2^0		+	O	-
0	X	X	X	X	+	X	O	O
1	X	X	X	O	O	X	X	O
2	X	X	O	X	-	O	O	X
3	X	X	O	O				
4	X	O	X	X				
5	X	O	X	O				
6	X	O	O	X				
7	X	O	O	O				
8	O	X	X	X				
9	O	X	X	O				

X denotes shorted to common
O denotes open

3.4.9 TYPE 791583 UPPER PANEL CONTROL (A10A1)

The upper panel control allows selection of detection mode, gain mode and meter mode. Each gang of switches mechanically operates to allow only one push-button to be depressed at any time. All control lines come from the Front Panel Interconnect card. The schematic diagram for this circuit is shown in Figure 6-20.

3.4.10 TYPE 791584 LOWER PANEL CONTROL (A10A2)

The lower panel control allows selection of IF bandwidth and variation of RF gain and phone level potentiometers. The schematic diagram for this circuit is Figure 6-20. This card also contains the amplifiers to drive the headphone outputs. The amplifiers operate independently. They receive the same signal in all detection modes except ISB. In this mode, Amplifier U1A receives the upper sideband information while U1B receives the lower sideband information. No damage will be done to the amplifiers when using mono headphones; however, LSB in the ISB mode will not be monitored.

3.5 POWER SUPPLY SECTION

Refer to the main chassis schematic diagram, Figure 6-20. The power supply section is shown in the upper left-hand corner of the schematic. The receiver may be operated from either 110 Vac ±15% or 220 Vac ±15%. This voltage feeds to

Filter Assembly FL1 which contains fuse F1, input voltage selection, and initial filtering. The receiver power switch, S1, is connected in series with one side of the ac line. The output of the voltage-select pc wafer connects through the power distribution board to transformer T1. This transformer has a dual primary with center-tapped secondaries, 34 Vac across pins 9 to 11 and 16 Vac across pins 6 to 8. Both potentials enter power distribution board A1.

3.5.1 TYPE 76240 POWER DISTRIBUTION (A1)

The power distribution board has 34 Vac and 16 Vac for an input and rectifies these voltages for various circuits and regulators in the receiver. The 34 Vac enters this board and is full-wave rectified by A1CR1, CR2, CR3 and CR4. The voltage is then filtered by A1C1 and A1C2 to be sent to regulators U1 and U2. The 16 Vac is rectified by CR1 and CR2, which are located on the back of the chassis, and returns to the distribution board to be filtered by A1C3 and A1C4 to become a +10 V unregulated supply.

3.5.2 POWER SUPPLY REGULATORS

U1 and U2 are located on the back of the chassis and provide regulated +15 Vdc and -15 Vdc, respectively. These two voltages are supplied to most of the circuits in the receiver. The unregulated 10 Vdc, with its unregulated ground connect to U3, a +5 Vdc regulator. U3 supplies +5 Vdc to the synthesizer, the up/down count board, and the front panel interconnect card. The unregulated 10 Vdc also connects to A5U1 and A5U2 which are +5 Vdc regulators for the 1st and 3rd LO Synthesizers. The unregulated ground for the +10 Vdc supply is regulated on the main chassis beneath the synthesizer motherboard. U1 and U2, on the rear panel, will automatically shut down when a current in excess of 1 amp is applied. Similarily, U3 on the rear panel will shut down when an input current in excess of 3 amps is applied.

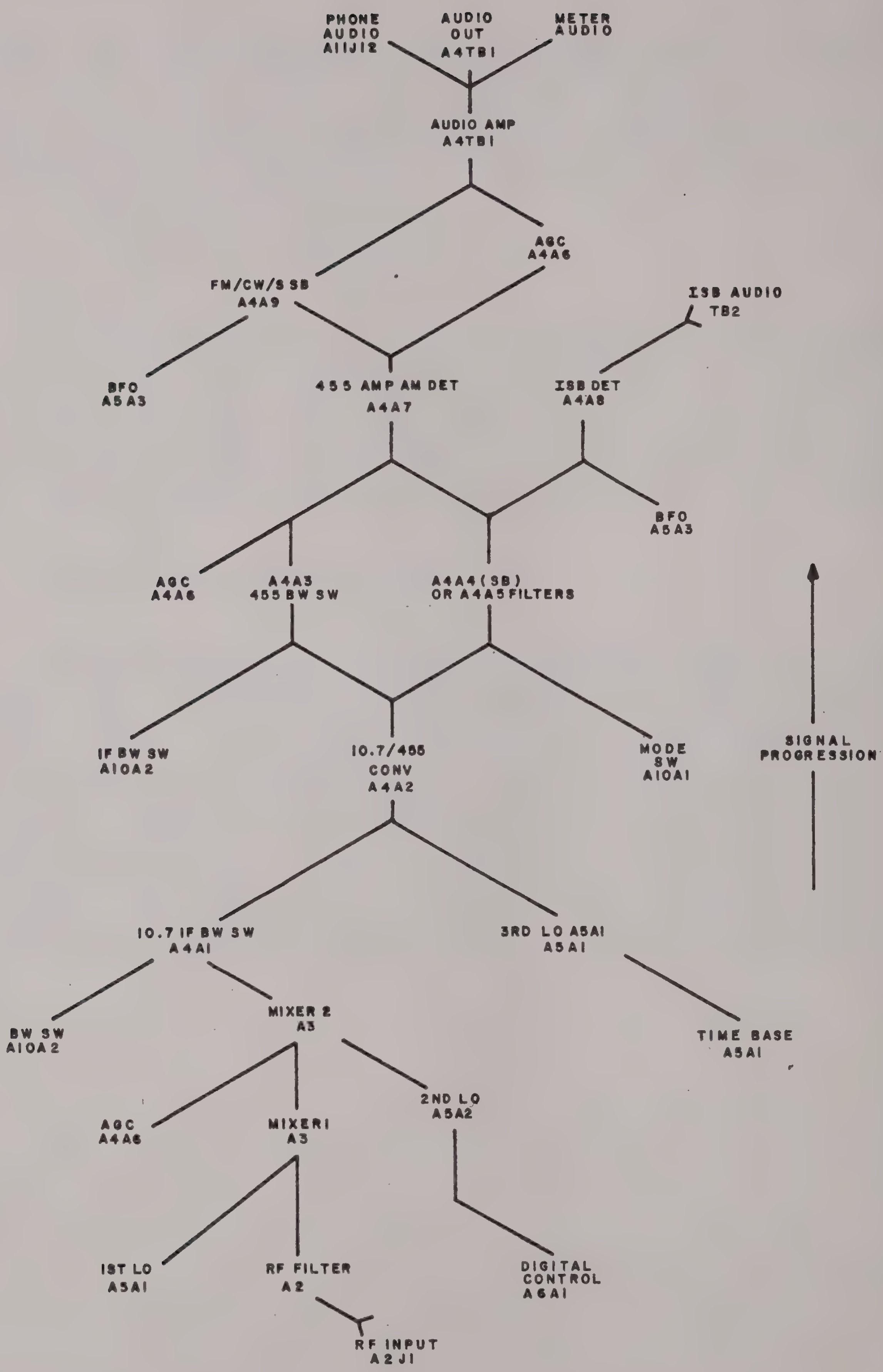

PHONE AUDIO A11J12
AUDIO OUT A4TB1
METER AUDIO
AUDIO AMP A4TB1
AGC A4A6
FM/CW/SSB A4A9
ISB AUDIO TB2
BFO A5A3
455 AMP AM DET A4A7
ISB DET A4A8
BFO A5A3
AGC A4A6
A4A3 455 BW SW
A4A4 (SB) OR A4A5 FILTERS
IF BW SW A10A2
10.7/455 CONV A4A2
MODE SW A10A1
SIGNAL PROGRESSION
10.7 IF BW SW A4A1
3RD LO A5A1 A5A1
BW SW A10A2
MIXER 2 A3
TIME BASE A5A1
2ND LO A5A2
AGC A4A6
MIXER1 A3
1ST LO A5A1
RF FILTER A2
DIGITAL CONTROL A6A1
RF INPUT A2J1

Figure 4-1. Receiver Section Functional Dependence Diagram

SECTION IV
MAINTENANCE

4.1 GENERAL

The WJ-8718 HF Receiver has been designed to operate for extended periods of time with minimum routine maintenance. Inspection and performance tests should be conducted at regular intervals consistant with the facility's normal scheduling and after troubleshooting. No routine adjustments are required. Troubleshooting and performance tests can be most effectively carried out if the technician first familiarizes himself with the operating instructions and circuit descriptions provided in Sections II and III, respectively. Parts lists and component location diagrams are in Section V.

4.2 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by making a visual inspection of the unit. For this reason, a complete visual inspection should be made on a regular basis and whenever the unit is inoperative. Components showing signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage due to overheating may be the result of other less apparent troubles in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts such as pin connectors and chassis wiring should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.3 COMPONENT LOCATION

Every component in the receiver can be located by utilizing the component location diagrams found in Section V. The component location diagrams are listed according to their reference designation prefix and can be found using the List of Illustrations in the front of the manual. For example, component A4A7R7 (a potentiometer used in the alignment procedures) can be found by turning to the component location drawing for A4A7. R7 is located in the upper left-hand corner of the circuit card. For further instruction on reference designations see paragraph 5.1.

4.4 REPAIR

When a trouble has been isolated to a specific circuit board or assembly, the user may decide to make the repair himself or return the board or assembly to the factory for replacement or repair. Some of the modules can be removed entirely, while in other cases only boards can be removed. The entire front panel along with the upper panel control, lower panel control, BFO switch, frequency display and the manual tuning module can be removed as a unit.

After a repair has been made, alignment should be carried out, if necessary, and appropriate performance tests should be used to verify proper operation.

When removing components from a printed-circuit board for inspection or replacement, be especially careful not to damage the track. The soldering iron power should be no larger than 40 watts, and a solder sipper or wicking procedure should be employed when removing solder. Non-corrosive soldering flux should be used when removing solder by wicking. In returning components to the board, make sure the holes are clear and be careful that the leads do not catch the edge of the track and lift it from the board. A good grade of rosin core 60/40 solder should be used. Heat no longer than is necessary to achieve a good joint. A heat sink should be used where possible.

4.5 TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 or equivalents are required for performing corrective maintenance. All the equipment, however, is not used in any one test.

4.6 PERFORMANCE TESTS

4.6.1 GENERAL

This performance test procedure may be used for initial inspection, periodic checks, or to confirm performance specifications after repairs have been made. This test determines if the receiver operates in all Detection Modes, Gain Modes, and IF Bandwidths. There are also tests to check Synthesizer and Power Supply performance. These tests should be carried out only by skilled technicians using the equipment listed in Table 4-1. If receiver problems exist while performing these tests, refer to the Troubleshooting Procedure, Section 4.7. A receiver control setting labeled "N/A" means "not applicable" and does not pertain to that particular test. When performing these tests, the technician should follow the guidelines below.

1. Read each paragraph carefully from beginning to end before attempting to perform the test described in the paragraph.

2. All tests are to be performed under the following environmental conditions unless otherwise specified:

Temperature	+25°C ± 5°C
Altitude	Room ambient
Humidity	Room ambient

3. All test equipment shall be allowed a warm-up period of at least 30 minutes before the start of any test.

4. All inputs to and outputs from the equipment under test which are not in use during any particular test are to be terminated with their characteristic impedances.

5. All equipment covers shall be in place unless a particular test requires their removal.

Table 4-1. Test Equipment Required

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Signal Generator	AM, FM, CW, RF out from -111 dBm to 0 dBm	HP8640B
Oscilloscope	DC to 50 MHz	Tektronix 455
RF Voltmeter	.001-3.0 V; -50 to +20 dBm.	Boonton 92B
Variable Transformer	Metered output, variable from 90-115 Vac	General Radio W5MT3A
Variable Transformer	Output variable from 180-220 Vac	General Radio W5HMT
Digital Counter	0 to 500 MHz	HP5303A
VTVM	AC and DC and ohms ranges	RCA WV-98C
DVM	DC ranges; 1% or better accuracy	Fluke 8100A
Dummy Load, 600 Ω	4 watt dissipation	2-1200Ω, 2 watt resistors in parallel
Dummy Load, 600 Ω	1/2 watt dissipation	2-1200Ω, 1/4 or 1/2 watt resistors in parallel
Headphones	Stereo, 600Ω impedance or Mono, 600Ω impedance	Telex 325-02 Telex 820-4

4.6.2 COMMON CIRCUITS PERFORMANCE TEST

1. Set the receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	AM
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	6 kHz
h. BFO Offset	N/A

2. Set the signal generator for an output of 15.00500 MHz, at -103 dBm unmodulated output. Connect signal generator to RF input connector A2J1 on back panel.

3. Connect RF voltmeter (terminated in 50 Ω) to IF output connector J12 on back panel. Also tune receiver to 15.005000 MHz.

4. The IF output read on the RF voltmeter should be roughly -21 dBm (20 millivolts) plus or minus a few dB. This reading should be apparent on all bandwidth settings and on AM, FM and CW modes.

5. Remove signal generator from RF input connector A2J1 and replace with a 50 Ω dummy load. Also, set front panel controls to AM mode in 6 kHz bandwidth.

6. IF output read on the RF voltmeter should be roughly -32 dBm or less.

7. If radio is dead or abnormal by above tests, refer to the Common Circuits Troubleshooting Tree. If radio appears normal in above test, even though it is dead, weak, noisy or abnormal in a specific detection mode, refer to appropriate Detection Mode Troubleshooting Tree.

4.6.3 AM PERFORMANCE TEST

1. Set the receiver controls as follows:

a. Power	OFF
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	AM
e. RF Gain	Maximum clockwise
f. Phone Level	Midway
g. IF Bandwidth	16 kHz
h. BFO Offset	N/A
i. Receiver Tuned Freq.	15.00500 MHz

2. Connect 600 Ω, 4 watt load to line audio output terminals on TB1 on back panel. Plug headphones into PHONES jack on front panel.

3. Energize receiver.

4. Set the signal generator for an output of 15.00500 MHz, 3 μV (-97 dBm) 50% modulated by 400 Hz. Connect signal generator to antenna input A2J1 on back panel.

5. A 400 Hz audio tone should be audible from headphones and Signal Strength meter should indicate a reading from 1/4 to 1/2 full scale.

6. Switch meter to line audio and set line audio control on rear panel to indicate a reading of +25 dBm. Connect the oscilloscope across the 4 watt 600 Ω load to observe approximately a 38 V peak-to-peak, 400 Hz sine wave (it may be desirable to temporarily switch to a 1 kHz BW to observe a clearer waveform).

7. Now switch the receiver through all IF Bandwidths. The meter reading and audio tone should remain essentially the same through all bandwidths except the 0.3 kHz bandwidth position (since the bandwidth is less than the modulation).

4.6.4 FM PERFORMANCE TEST

1. Set the receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength

c. Gain Mode	Manual
d. Detection Mode	FM
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	16 kHz
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Set signal generator for FM modulation by 400 Hz audio with a deviation of 5.6 kHz and an output of 3 μV (approximately -97 dBm).

3. A 400 Hz audio tone should be heard from the headphones and also visible on oscilloscope connected to 600 Ω, 4 watt load on line audio output.

4.6.5 CW PERFORMANCE TEST

1. Set receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	CW
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	16 kHz
h. BFO Offset	+0.4 (kHz)
i. Receiver Tuned Frequency	15.00500 MHz

2. Tune signal generator to 15.00500 MHz, unmodulated RF carrier, 3 μV (-97 dBm).

3. A 400 Hz audio tone should be heard from the headphones.

4. Change the BFO Offset to -0.4 (kHz).

5. Again an audio tone should be heard from the headphones.

6. Switch IF Bandwidth through all bandwidth positions (i.e., 16, 6, 3.2, 1.0, 0.3 kHz) noting that a 400 Hz tone is audible in all positions.

4.6.6 USB PERFORMANCE TEST

1. Set receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	USB
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	N/A
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Tune signal generator to 15.00540 MHz, 3μV (-97 dBm).

3. A 400 Hz audio tone should be heard from the speaker of the headphones.

4. A tone should also be heard when switching the Detection Mode to ISB.

4.6.7 LSB PERFORMANCE TEST

1. Set the receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	LSB
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	N/A
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Tune signal generator to 15.00460 MHz, 3 μV (-97 dBm).

3. A 400 Hz audio tone should be heard from the speaker of the headphones.

4. A tone should also be heard when switching the Detection Mode to ISB.

4.6.8 ISB PERFORMANCE TEST

1. Set the receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	ISB
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	N/A
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Connect a 600 Ω, 1/2 watt load to ISB Line Audio output terminals of TB2 on back panel.

3. Tune signal generator to 15.00460 MHz, 3 μV (-9w dBm). Connect oscilloscope, set at 2 V/div, across the 600 Ω ISB Line Audio (this level will depend on the setting of A4A8R36).

4. A 400 Hz audio tone should be heard in one speaker of the headphones and also observed on the scope.

5. Tune signal generator to 15.00540 MHz, 3 μV (-97 dBm). Connect oscilloscope, set at 2V/div, across 600 Ω Line Audio Output on TB1.

6. A 400 Hz Audio tone should be heard in the other speaker of the headphones and also observed on the scope. This tone should not come from the same speaker as in Step 3.

4.6.9 MANUAL GAIN PERFORMANCE TEST

1. Set receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	AM
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	6 kHz
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Set signal generator to 15.00500 MHz, on modulated at 3.0 μV (-97 dBm).

3. With MANUAL GAIN control fully clockwise, note signal strength meter reading. Measure IF output from BNC with an RF millivoltmeter terminated in 50 Ω.

4. RF millivoltmeter should read roughly 40 millivolts.

5. Increase RF from the signal generator in 10 dB steps while maintaining the same signal strength reading on the meter by adjusting the MANUAL GAIN CONTROL.

6. Continue this increase for 10 steps or until output of the signal generator has been increased by 100 dB. If operator is able to maintain a meter reading, MANUAL GAIN is operational.

4.6.10 AGC PERFORMANCE TEST

1. Set receiver controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Fast AGC
d. Detection Mode	AM
e. RF Gain	N/A
f. Phone Level	Midway
g. IF Bandwidth	6 kHz
h. BFO Offset	N/A
i. Receiver Tuned Frequency	15.00500 MHz

2. Set signal generator to 15.00500, unmodulated, at 0.1 μV.

3. Increase RF output of signal generator until Signal Strength Meter just moves off zero.

4. Increase RF input to receiver in 10 dB steps for a total of 10 steps or until 100 dB is reached. If a reading is still on the scale, Fast AGC is operational.

5. Switch GAIN Mode to Slow AGC and decrease RF input in 10 dB steps.

6. There should be a slight delay in the dropping of the meter reading to each new level (which indicates the slow AGC time constant).

7. If a reading is still on the scale after 8 steps and a delay is observed, Slow AGC is operational.

4.6.11 SYNTHESIZER PERFORMANCE TEST

An improperly operating synthesizer usually causes the RF signal to be translated to an incorrect frequency. The following test provides a reasonable assurance that the four synthesizers are operating correctly. For more exact testing, refer to the individual alignment and troubleshooting procedures.

Zero-beating the receiver against a known frequency station -- such as WWV-- gives a fair indication of correct operating frequency. Other stations can be found in Table 4-2, which lists transmitting stations all over the world.

1. Set the receiver controls as follows:

a.	Power	ON
b.	Meter	Signal Strength
c.	Gain Mode	Fast
d.	Detection Mode	CW
e.	RF Gain	N/A
f.	Phone Level	Midway
g.	IF Bandwidth	3.2 kHz
h.	BFO Offset	+0.0 (kHz)
i.	Tuned Frequency	As required
j.	S2 (Rear Panel)	Internal Clock

2. Tune to a standard-frequency station and zero-beat the receiver.

3. Frequency displayed on the digital readout should indicate the station frequency.

4. An alternate procedure may also be used; however, it eliminates the receiver time base from the test. To use this alternate method, perform step 1 then proceed to step 5.

5. Connect a short piece of coaxial cable with two BNC male connectors from RF input jack A2J1 to 1 MHz output reference jack J11.

Table 4-2. Standard Frequency Stations

Carrier Freq. (MHz)	Call Sign	Location	Modulation (Hz)	Carrier Power (kW)
2.50	FFH	Paris, France	1, 440, 1000	0.30
2.50	JJY	Tokyo, Japan	1, 1000	2.00
2.50	MSF	Rugby, England	1, 1000	0.50
2.50	OMA	Prague, Czechoslovakia	1, 1000	1.00
2.50	WWV	Ft. Collins, Colorado	1, 100, 440, 600, 1000, 1500	2.50
2.50	WWVH	Kekaha, Hawaii	1, 100, 500, 600, 1200	2.50
2.50	ZLFS	Lower Huti, New Zealand	None	0.03
3.33	CHU	Ottawa, Canada	1, 1000	3.00
4.50	VNG	Lyndhurst, Australia	1, 1000	10.00
5.00	IAM	Rome, Italy	1, 1000	1.00
5.00	IBF	Turin, Italy	1, 1000	5.50
5.00	JJY	Tokyo, Japan	1, 1000	2.00
5.00	LOL	Buenos Aires, Argentina	1, 440, 1000	2.00
5.00	MSF	Rugby, England	1, 1000	0.50
5.00	RWM	Moscow, U.S.S.R.	1	20.00
5.00	WWV	Fort Collins, Colorado	1, 100, 440, 600, 1000, 1500	10.00
5.00	WWVH	Kekaha, Hawaii	1, 100, 500, 600, 1200	10.00
5.00	ZUO	Olitantstontein, S. Africa	1	4.00
7.335	CHU	Ottawa, Canada	1, 1000	3.00
7.50	VNG	Lyndhurst, Australia	1, 1000	10.00
10.00	ATA	New Delhi, India	1, 1000	1.00
10.00	JJY	Tokyo, Japan	1, 1000	2.00
10.00	LOL	Buenos Aires, Argentina	1, 440, 1000	2.00
10.00	MSF	Rugby, England	1, 1000	0.50
10.00	RWM	Moscow, U.S.S.R.	1	20.00
10.00	WWV	Fort Collins, Colorado	1, 100, 440, 600, 1000, 1500	10.00
10.00	WWVH	Kekaha, Hawaii	1, 100, 500, 600, 1200	10.00
10.00	ZUO	Olitantstontein, S. Africa	1	4.00
12.00	VNG	Lyndhurst, Australia	1, 1000	10.00
14.67	CHU	Ottawa, Canada	1, 1000	3.00
15.00	JJY	Tokyo, Japan	1, 1000	2.00
15.00	LOL	Buenos Aires, Argentina	1, 440, 1000	2.00
15.00	RWM	Moscow, U.S.S.R.	1	20.00
15.00	WWV	Fort Collins, Colorado	1, 100, 440, 600, 1000, 1500	10.00
15.00	WWVH	Kekaha, Hawaii	1, 100, 500, 600, 1200	10.00

6. Tune the receiver to any even or odd harmonic of 1 MHz. Zero-beat the receiver.

7. Frequency displayed on the digital readout should indicate an exact multiple of 1 MHz.

4.6.12 POWER SUPPLY PERFORMANCE TEST

1. Connect the receiver through a metered variable transformer to the ac power source. If the variable transformer is unmetered, connect an ac voltmeter across the secondary to monitor the voltage.

2. Adjust the variable transformer voltage output level to 100, 120, 220, or 240 Vac, whichever is appropriate for the setting of the line voltage pc wafer. Energize the receiver.

3. Vary the transformer from the minimum to the maximum voltage values appropriate for the selected line voltage, as shown in Table 4-3.

4. With a digital voltmeter, monitor the three supply voltages of the receiver: ±15 Vdc, and +5 Vdc. Test points for the ±15 Vdc can be found under the converter section. The test point for +5 Vdc can be found in the right corner of the synthesizer section.

5. The supply voltages should not exceed those limits shown in Table 4-3.

Table 4-3. Supply Voltage Parameters

LINE VOLTAGE PC SELECT	MINIMUM	MAXIMUM	SUPPLY	LIMITS
100 Vac	94 Vac	110 Vac	+15 Vdc	14.15 to 15.85 Vdc
120 Vac	110 Vac	126 Vac	-15 Vdc	-15.85 to -14.15 Vdc
220 Vac	187 Vac	220 Vac	+5 Vdc	4.50 to 5.50 Vdc
240 Vac	220 Vac	253 Vac		

4.7 TROUBLESHOOTING PROCEDURES

4.7.1 GENERAL

Troubleshooting efforts should first be directed toward eliminating possible external causes of the trouble and ascertaining correct symptoms with the unit properly connected and tested. Occasionally, the main circuit causing the trouble can be pinpointed by noting that the symptom occurs only for operating modes which involve a certain circuit. On the other hand, symptoms which occur for several modes would tend to lead the troubleshooter to circuitry which is active for all these modes. Figure 4-1 may be helpful in understanding the dependence of each circuit in the receiver.

The following troubleshooting procedures divide the receiver into four major sections: receiver section, digital control section, synthesizer section, and power supply section. Localizing the trouble to one of these four major sections can be accomplished by observing the results during operation.

4.7.2 RECEIVER SECTION TROUBLESHOOTING PROCEDURE

The following procedure tests the signal processing circuits of the receiver. This procedure should be followed exactly to obtain the best results. Figure 4-2 illustrates the breakdown of the receiver section troubleshooting procedure. The performance tests in paragraph 4.6.2 through 4.6.12 should be conducted first to isolate the trouble to either a common circuit or a detection mode. From here, the appropriate common circuit or detection mode troubleshooting tree, Figures 4-3 through 4-9, should be used to isolate the trouble to a specific circuit card. Then the appropriate circuit card troubleshooting tree, Figures 4-9 through 4-18, is used to determine the trouble to a circuit level. In summary, the receiver section troubleshooting procedure should be conducted as follows:

1. Use all the performance tests to isolate the problem to a detection mode or common circuit.

2. Use the detection mode or common circuits troubleshooting trees to isolate the problem to a specific card.

3. Use circuit card troubleshooting trees to isolate the problem to a specific circuit.

Some qualifying statements are needed about the troubleshooting trees in this section. If a test leads to a "detection mode normal" or "card normal" statement, the problem that exists is not contained in that circuit card or detection mode. If a test leads to a "trouble in interface or front panel" statement, the problem exists in either the control signal supplied to the board, the input or output connections to the board, or any other wiring connected to the board.

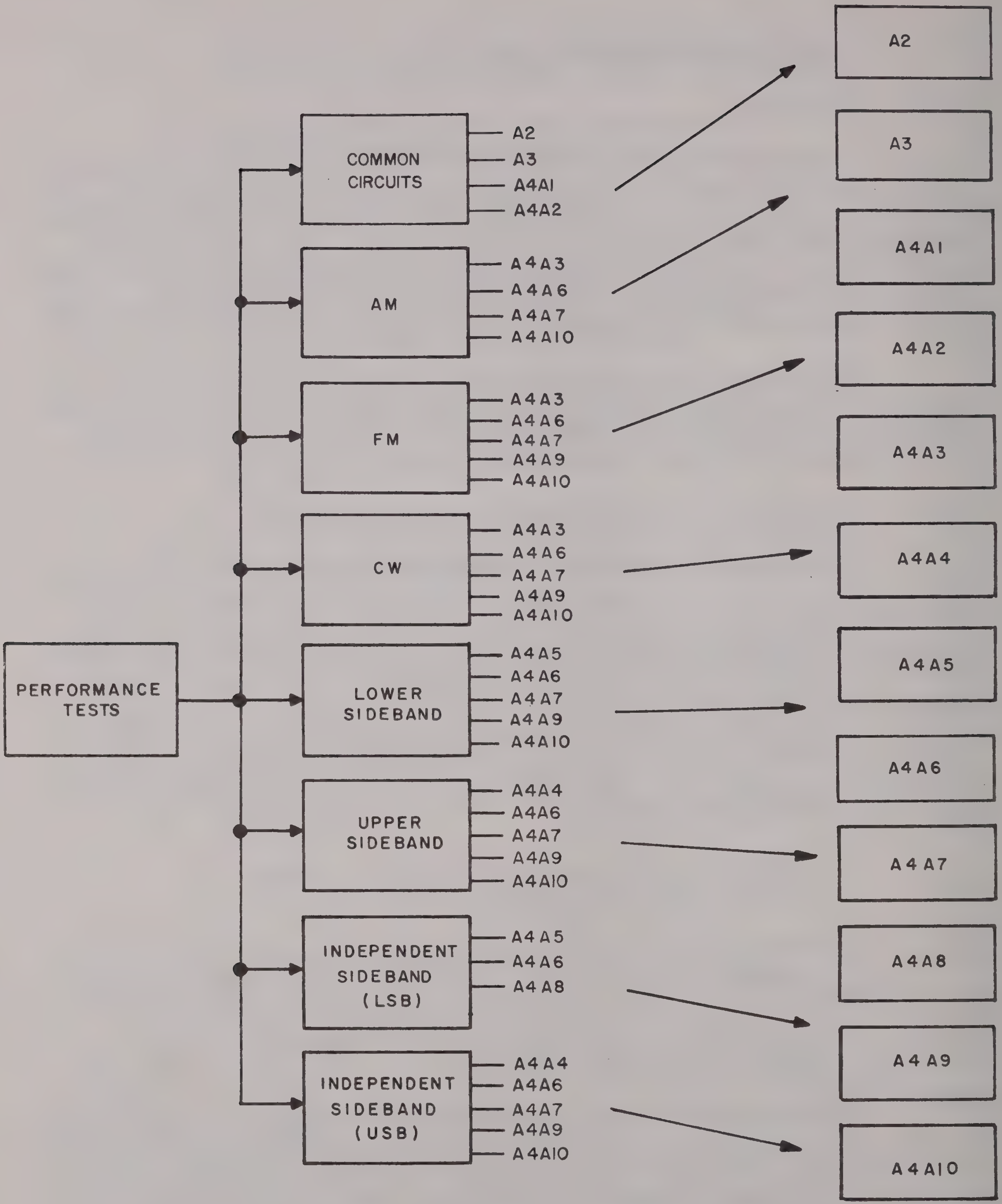
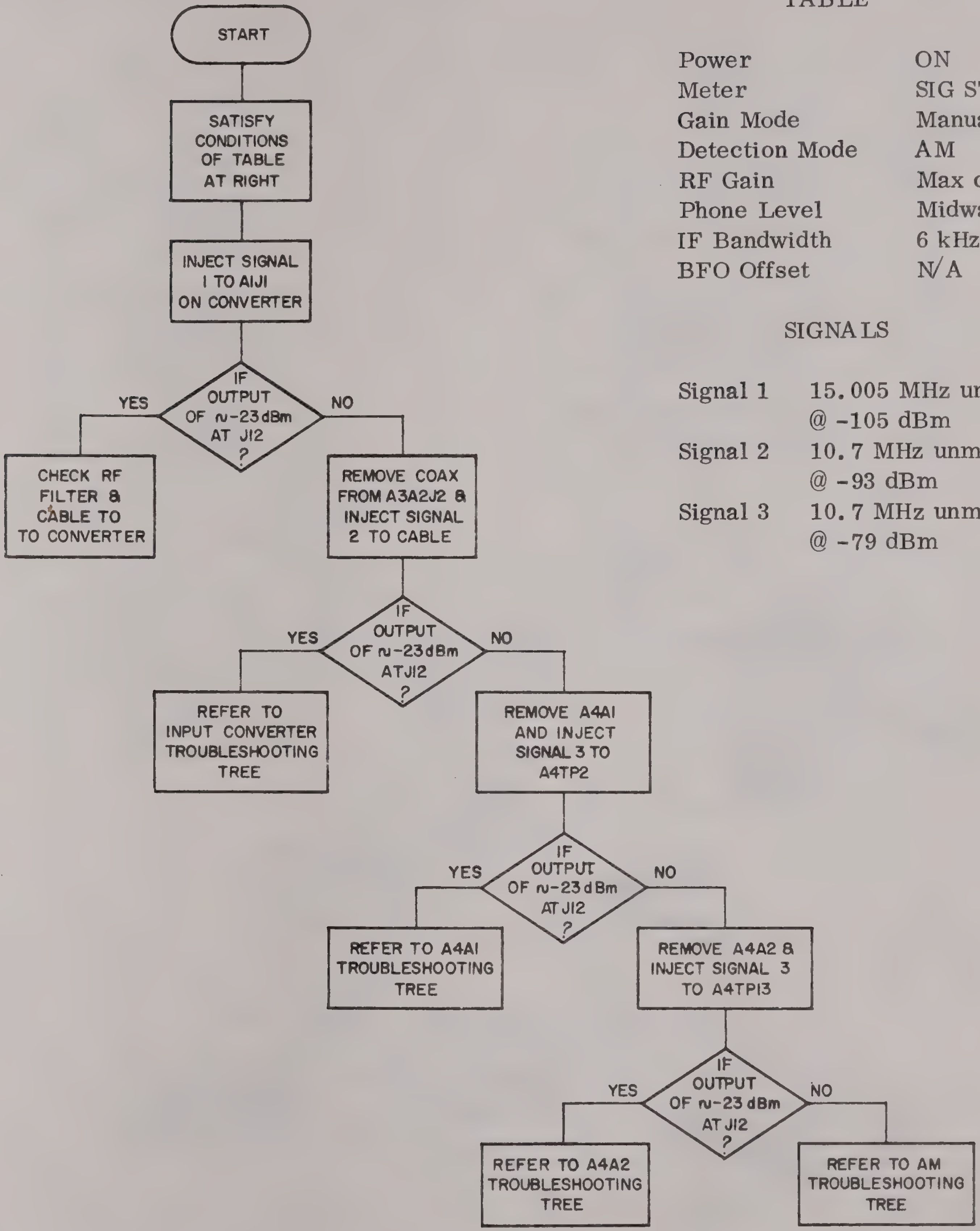

PERFORMANCE TESTS
COMMON CIRCUITS
A2
A3
A4A1
A4A2
AM
A4A3
A4A6
A4A7
A4A10
FM
A4A3
A4A6
A4A7
A4A9
A4A10
CW
A4A3
A4A6
A4A7
A4A9
A4A10
LOWER SIDEBAND
A4A5
A4A6
A4A7
A4A9
A4A10
UPPER SIDEBAND
A4A4
A4A6
A4A7
A4A9
A4A10
INDEPENDENT SIDEBAND (LSB)
A4A5
A4A6
A4A8
INDEPENDENT SIDEBAND (USB)
A4A4
A4A6
A4A7
A4A9
A4A10
A2
A3
A4A1
A4A2
A4A3
A4A4
A4A5
A4A6
A4A7
A4A8
A4A9
A4A10

Figure 4-2. Receiver Section Troubleshooting Scheme


START
SATISFY CONDITIONS OF TABLE AT RIGHT
INJECT SIGNAL 1 TO A1J1 ON CONVERTER
IF OUTPUT OF ~-23 dBm AT J12 ?
YES
NO
CHECK RF FILTER & CABLE TO TO CONVERTER
REMOVE COAX FROM A3A2J2 & INJECT SIGNAL 2 TO CABLE
IF OUTPUT OF ~-23 dBm AT J12 ?
YES
NO
REFER TO INPUT CONVERTER TROUBLESHOOTING TREE
REMOVE A4A1 AND INJECT SIGNAL 3 TO A4TP2
IF OUTPUT OF ~-23 dBm AT J12 ?
YES
NO
REFER TO A4A1 TROUBLESHOOTING TREE
REMOVE A4A2 & INJECT SIGNAL 3 TO A4TP13
IF OUTPUT OF ~-23 dBm AT J12 ?
YES
NO
REFER TO A4A2 TROUBLESHOOTING TREE
REFER TO AM TROUBLESHOOTING TREE

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	AM
RF Gain	Max clockwise
Phone Level	Midway
IF Bandwidth	6 kHz
BFO Offset	N/A

SIGNALS

Signal 1	15.005 MHz unmodulated @ -105 dBm
Signal 2	10.7 MHz unmodulated @ -93 dBm
Signal 3	10.7 MHz unmodulated @ -79 dBm

Figure 4-3. Common Circuits Troubleshooting Tree

WJ-8718 HF RECEIVER

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	AM
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	6 kHz
BFO Offset	N/A

LOGIC SIGNALS

A4A3 Pin 15	+5 Vdc
A4A3 Pins 17, 19	0 Vdc
A4A4 Pins 49, 51	0 Vdc
A4A5 Pins 49, 51	0 Vdc
A4A6 Pin 13	+5 Vdc
A4A8 Pin 49	0 Vdc
A4A9 Pins 41, 43	0 Vdc
A4A10 Pin 47	+5 Vdc

SIGNALS

Signal 1	455 kHz modulated 50% by 400 Hz @ -70 dBm
Signal 2	455 kHz modulated 50% by 400 Hz @ -58 dBm
Signal 3	400 Hz Audio @ 0.7 Vrms

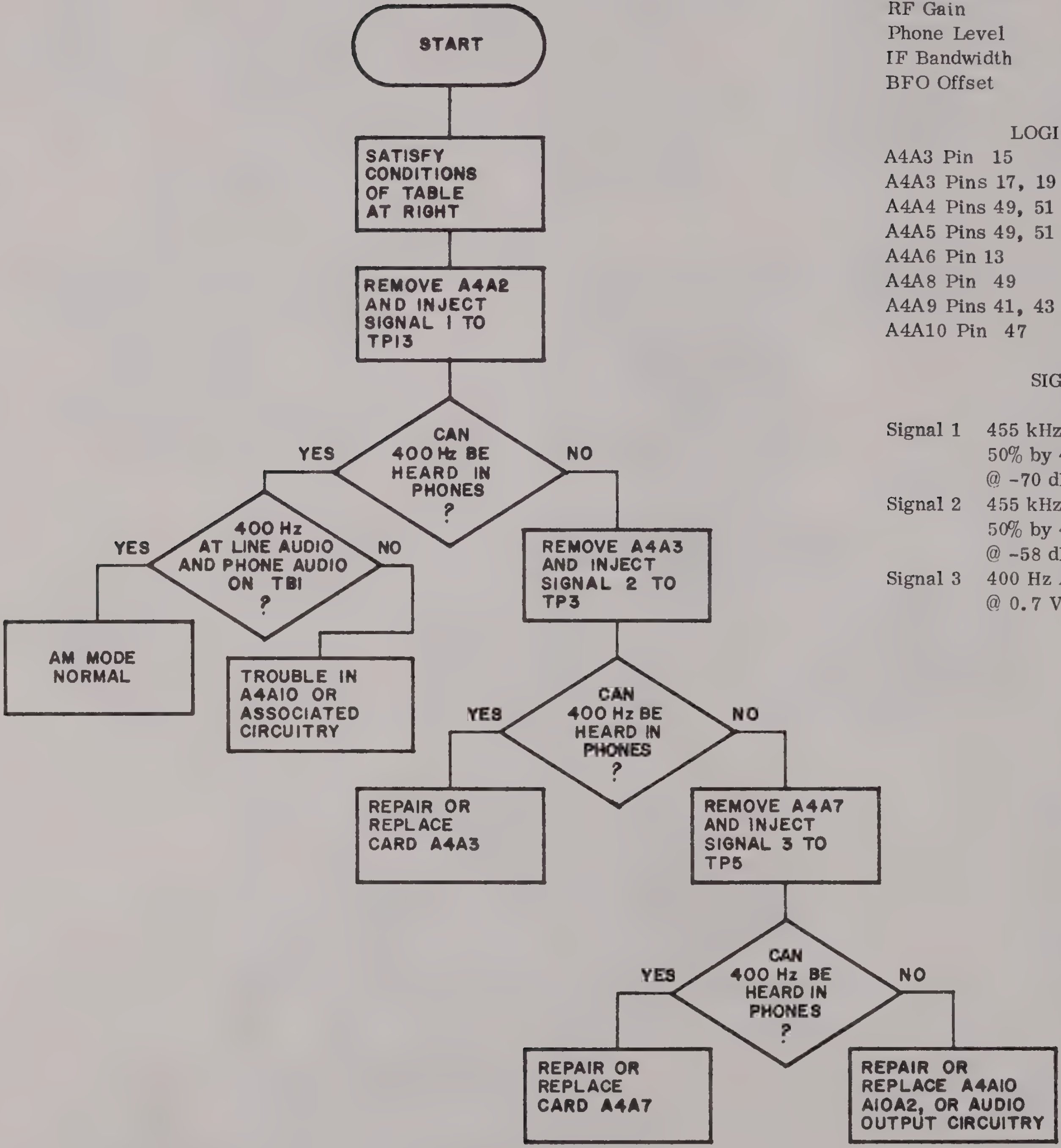
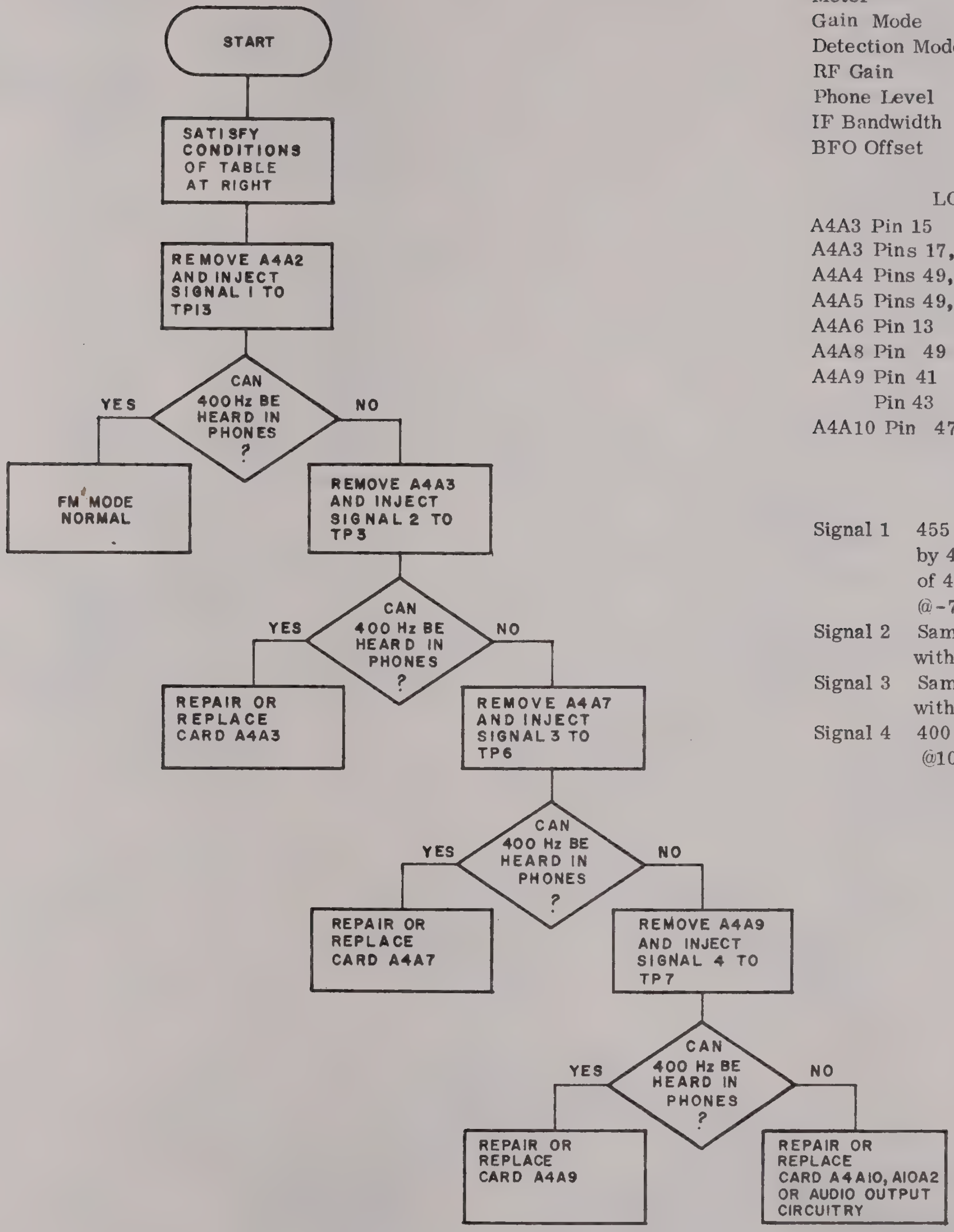

START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP13
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
400 Hz AT LINE AUDIO AND PHONE AUDIO ON TB1 ?
YES
NO
AM MODE NORMAL
TROUBLE IN A4A10 OR ASSOCIATED CIRCUITRY
REMOVE A4A3 AND INJECT SIGNAL 2 TO TP3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A3
REMOVE A4A7 AND INJECT SIGNAL 3 TO TP5
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A7
REPAIR OR REPLACE A4A10 A10A2, OR AUDIO OUTPUT CIRCUITRY

Figure 4-4. AM Troubleshooting Tree


START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP13
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
FM MODE NORMAL
REMOVE A4A3 AND INJECT SIGNAL 2 TO TP3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A3
REMOVE A4A7 AND INJECT SIGNAL 3 TO TP6
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A7
REMOVE A4A9 AND INJECT SIGNAL 4 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A9
REPAIR OR REPLACE CARD A4A10, A10A2 OR AUDIO OUTPUT CIRCUITRY

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	FM
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	16 kHz
BFO Offset	N/A

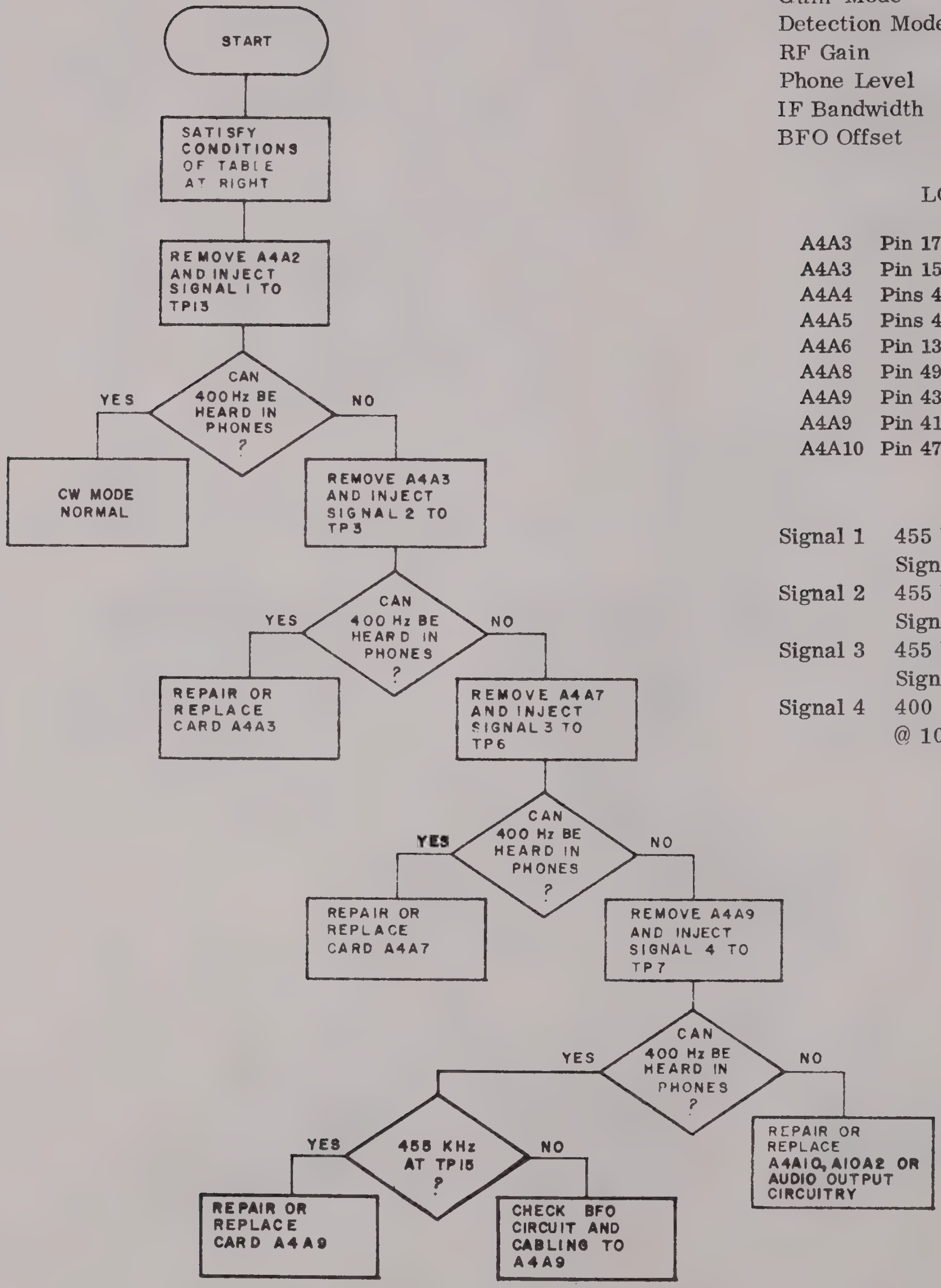
LOGIC SIGNALS

A4A3 Pin 15	+5 Vdc
A4A3 Pins 17, 19	0 Vdc
A4A4 Pins 49, 51	0 Vdc
A4A5 Pins 49, 51	0 Vdc
A4A6 Pin 13	+5 Vdc
A4A8 Pin 49	0 Vdc
A4A9 Pin 41	+5 Vdc
Pin 43	0 Vdc
A4A10 Pin 47	0 Vdc

SIGNALS

Signal 1	455 kHz FM unmodulated by 400 Hz with a deviation of 4 kHz @-70 dBm
Signal 2	Same as Signal 1 with -58 dBm
Signal 3	Same as Signal 1 with -37 dBm
Signal 4	400 Hz Audio signal @100 mV

Figure 4-5. FM Troubleshooting Tree


START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP13
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CW MODE NORMAL
REMOVE A4A3 AND INJECT SIGNAL 2 TO TP3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A3
REMOVE A4A7 AND INJECT SIGNAL 3 TO TP6
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A7
REMOVE A4A9 AND INJECT SIGNAL 4 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE A4A10, A10A2 OR AUDIO OUTPUT CIRCUITRY
455 KHz AT TP15 ?
YES
NO
REPAIR OR REPLACE CARD A4A9
CHECK BFO CIRCUIT AND CABLING TO A4A9

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	CW
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	3.2 kHz
BFO Offset	+0.4 kHz

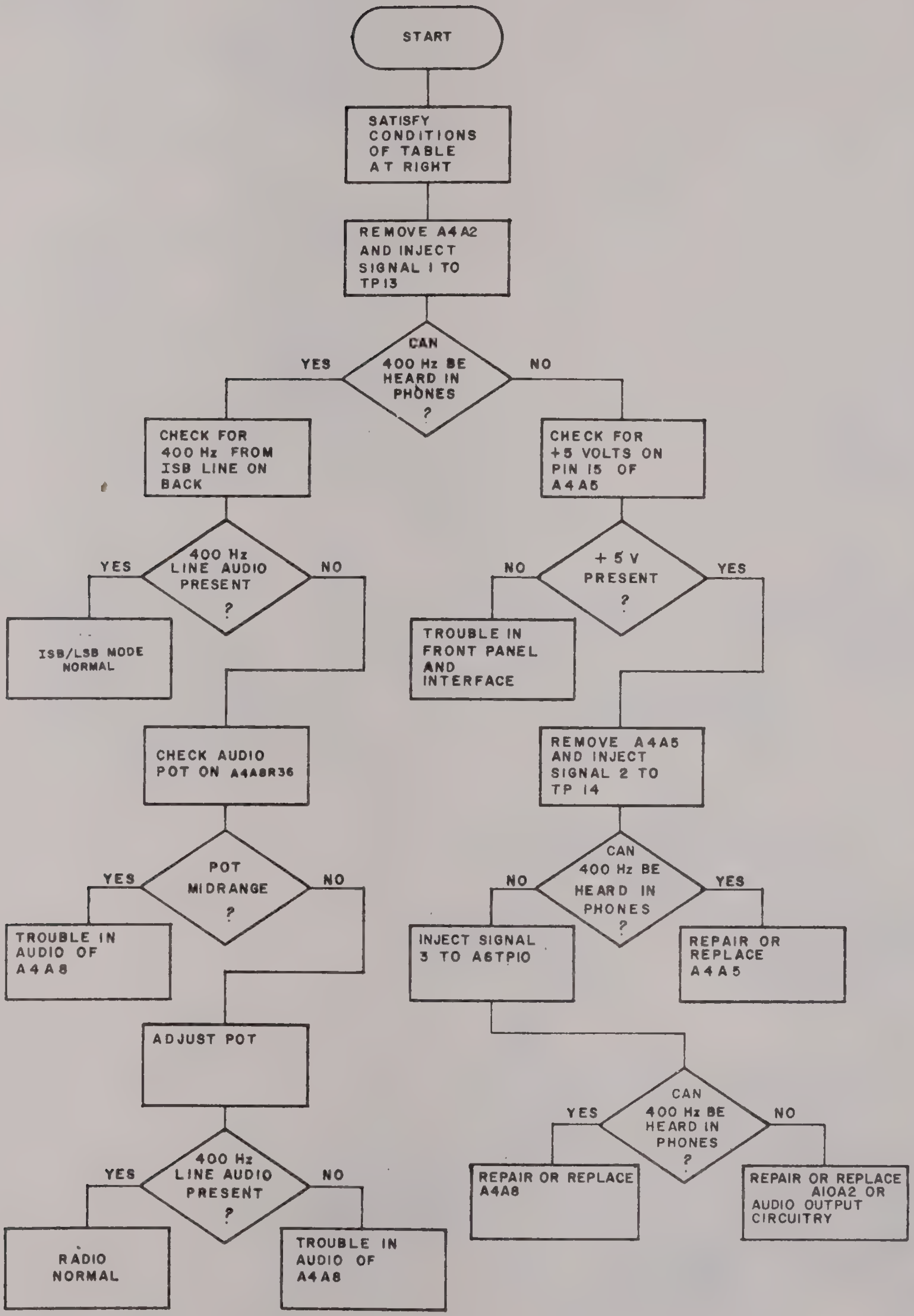
LOGIC SIGNALS

A4A3	Pin 17, 19	0 Vdc
A4A3	Pin 15	+5 Vdc
A4A4	Pins 49, 51	0 Vdc
A4A5	Pins 49, 51	0 Vdc
A4A6	Pin 13	+5 Vdc
A4A8	Pin 49	0 Vdc
A4A9	Pin 43	+5 Vdc
A4A9	Pin 41	0 Vdc
A4A10	Pin 47	0 Vdc

SIGNALS

Signal 1	455 kHz unmodulated Signal @ -70 dBm
Signal 2	455 kHz modulated Signal @ -58 dBm
Signal 3	455 kHz unmodulated Signal @ -37 dBm
Signal 4	400 Hz Audio signal @ 100 mV

Figure 4-6. CW Troubleshooting Tree


START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP13
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CHECK FOR 400 Hz FROM ISB LINE ON BACK
CHECK FOR +5 VOLTS ON PIN 15 OF A4A5
400 Hz LINE AUDIO PRESENT ?
YES
NO
ISB/LSB MODE NORMAL
+5 V PRESENT ?
NO
YES
TROUBLE IN FRONT PANEL AND INTERFACE
CHECK AUDIO POT ON A4A8R36
REMOVE A4A5 AND INJECT SIGNAL 2 TO TP 14
POT MIDRANGE ?
YES
NO
TROUBLE IN AUDIO OF A4A8
CAN 400 Hz BE HEARD IN PHONES ?
NO
YES
INJECT SIGNAL 3 TO A8TP10
REPAIR OR REPLACE A4A5
ADJUST POT
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE A4A8
REPAIR OR REPLACE A10A2 OR AUDIO OUTPUT CIRCUITRY
400 Hz LINE AUDIO PRESENT ?
YES
NO
RADIO NORMAL
TROUBLE IN AUDIO OF A4A8

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	ISB
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	N/A
BFO Offset	N/A

LOGIC SIGNALS

A4A3	Pins 15, 17, 19	0 Vdc
A4A4	Pin 51	+5 Vdc
	Pin 49	0 Vdc
A4A5	Pin 51	+5 Vdc
	Pin 49	0 Vdc
A4A6	Pin 13	+5 Vdc
A4A8	Pin 49	+5 Vdc
A4A9	Pin 41	0 Vdc
A4A9	Pin 43	+5 Vdc
A4A10	Pin 47	0 Vdc

SIGNALS

Signal 1	454.6 kHz unmodulated Signal @ -70 dBm
Signal 2	454.6 kHz unmodulated Signal @ -58 dBm
Signal 3	400 Hz Audio Signal @ 100mV

For USB Portion of ISB detection mode, use the USB Troubleshooting Tree with the following changes: Detection Mode ISB

A4A4 Pin 49 0 Vdc
A4A4 Pin 51 5 Vdc
A4A5 Pin 51 5 Vdc

Figure 4-7. ISB (LSB Portion) Troubleshooting Tree

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	USB
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	N/A
BFO Offset	N/A

LOGIC SIGNALS

A4A3	Pins 15,17,19	0 Vdc
A4A4	Pin 49	+5 Vdc
	Pin 51	0 Vdc
A4A5	Pins 49, 51	0 Vdc
A4A6	Pin 13	+5 Vdc
A4A8	Pin 49	0 Vdc
A4A9	Pin 43	+5 Vdc
A4A9	Pin 41	0 Vdc
A4A10	Pin 47	0 Vdc

SIGNALS

Signal 1	455.4 kHz unmodulated Signal @ -70 dBm
Signal 2	455.4 kHz modulated Signal @ -58 dBm
Signal 3	455.4 kHz unmodulated Signal @ -37 dBm
Signal 4	400 Hz Audio signal @ 100 mV

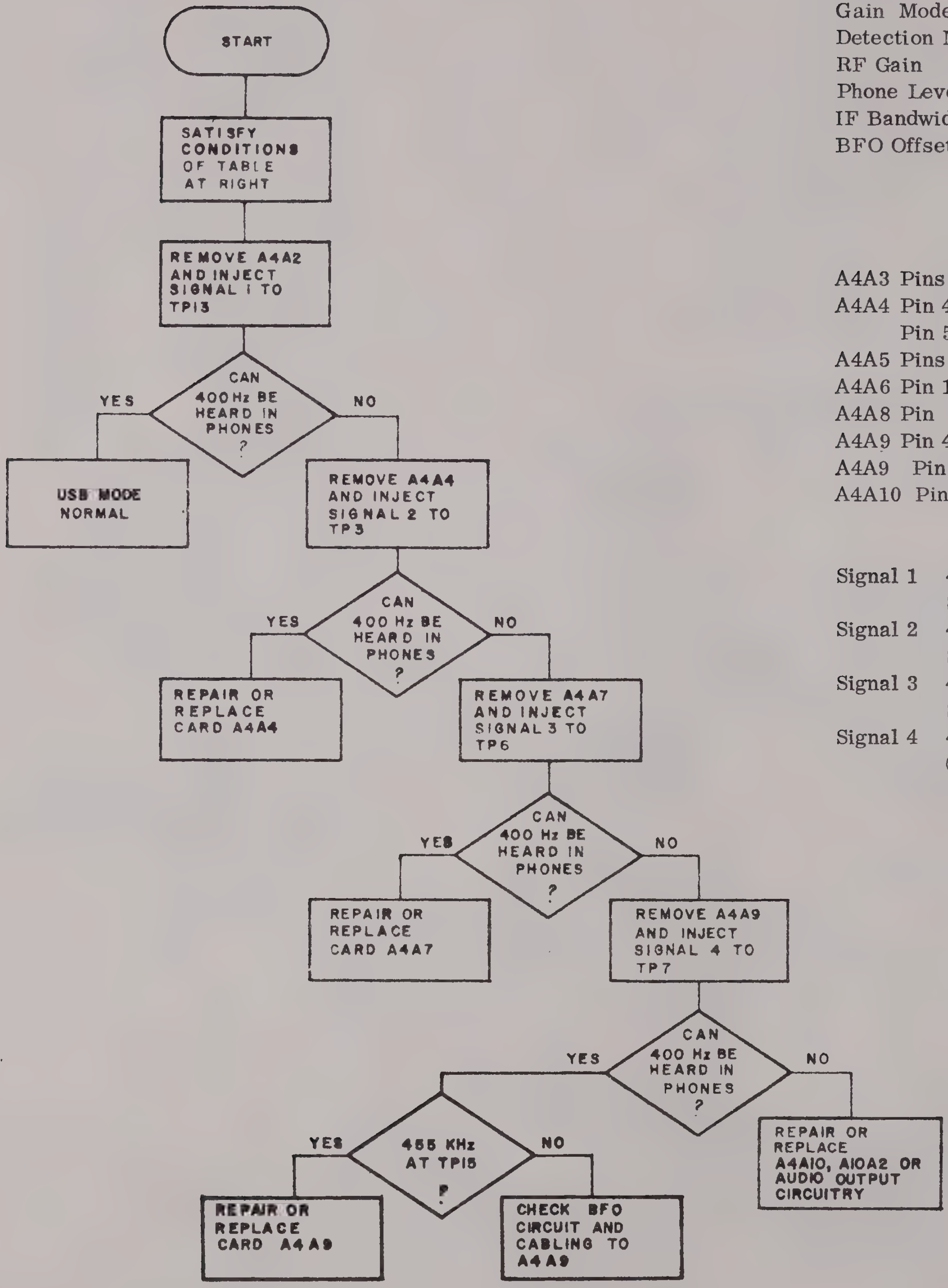

START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP13
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
USB MODE NORMAL
REMOVE A4A4 AND INJECT SIGNAL 2 TO TP3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A4
REMOVE A4A7 AND INJECT SIGNAL 3 TO TP6
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A7
REMOVE A4A9 AND INJECT SIGNAL 4 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE A4A10, A10A2 OR AUDIO OUTPUT CIRCUITRY
455 KHz AT TP15 ?
YES
NO
REPAIR OR REPLACE CARD A4A9
CHECK BFO CIRCUIT AND CABLING TO A4A9

Figure 4-8. USB Troubleshooting Tree

TABLE

Power	ON
Meter	SIG STR
Gain Mode	Manual
Detection Mode	LSB
RF Gain	Max Clockwise
Phone Level	Midway
IF Bandwidth	N/A
BFO Offset	N/A

LOGIC SIGNALS

A4A3 Pins 15, 17	0 Vdc
A4A4 Pins 49, 51	0 Vdc
A4A5 Pin 49	+5 Vdc
A4A6 Pin 13	+5 Vdc
A4A8 Pin 49	0 Vdc
A4A9 Pin 43	+5 Vdc
A4A9 Pin 41	0 Vdc
A4A10 Pin 47	0 Vdc

SIGNALS

Signal 1	454.6 kHz unmodulated Signal @ -70 dBm
Signal 2	454.6 kHz unmodulated Signal @ -58 dBm
Signal 3	454.6 kHz unmodulated Signal @ -37 dBm
Signal 4	400 Hz Audio Signal @ 100 mV

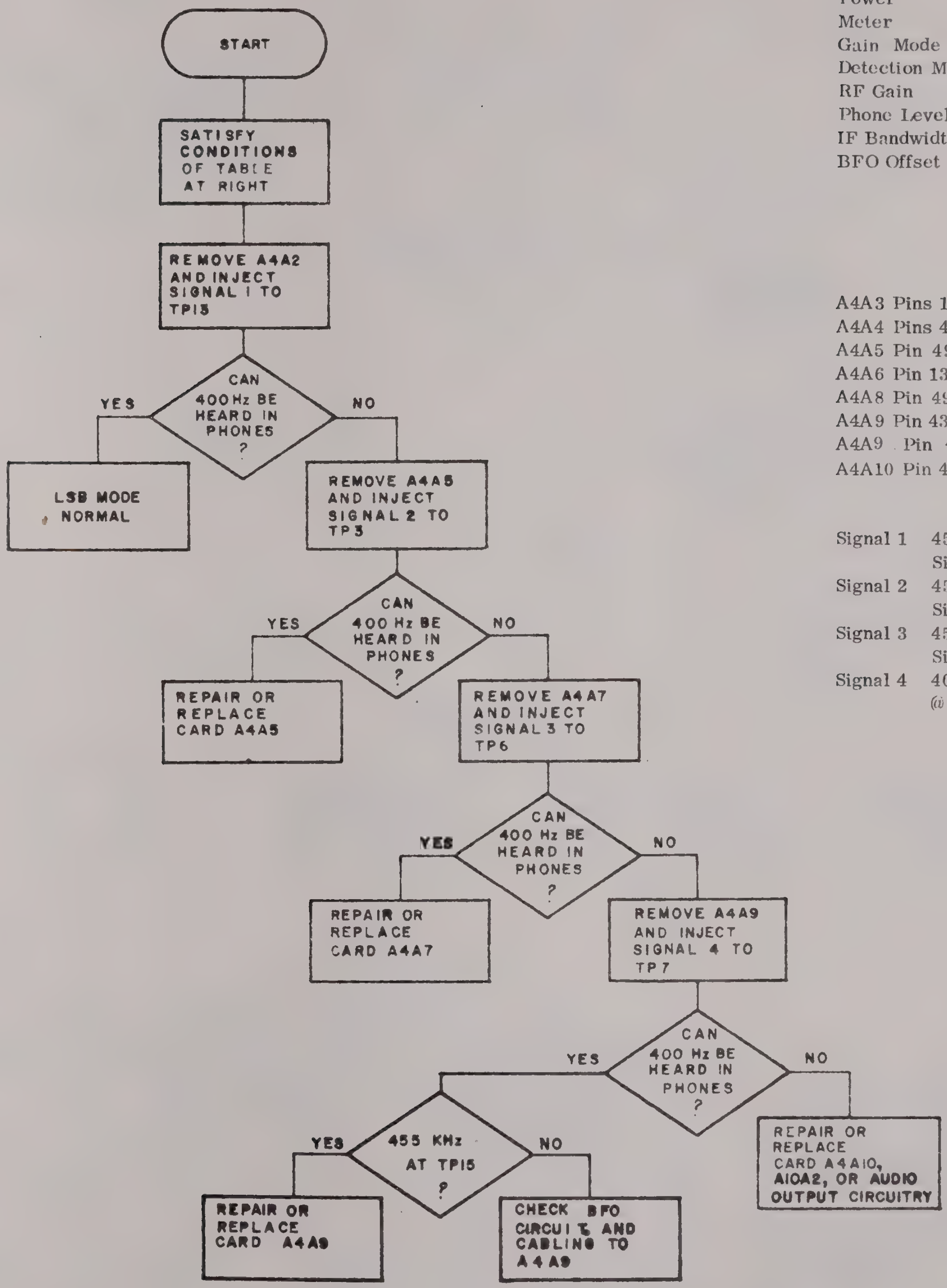

START
SATISFY CONDITIONS OF TABLE AT RIGHT
REMOVE A4A2 AND INJECT SIGNAL 1 TO TP15
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
LSB MODE NORMAL
REMOVE A4A5 AND INJECT SIGNAL 2 TO TP3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A5
REMOVE A4A7 AND INJECT SIGNAL 3 TO TP6
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A7
REMOVE A4A9 AND INJECT SIGNAL 4 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
REPAIR OR REPLACE CARD A4A10, A10A2, OR AUDIO OUTPUT CIRCUITRY
455 KHz AT TP15 ?
YES
NO
REPAIR OR REPLACE CARD A4A9
CHECK BFO CIRCUIT AND CABLING TO A4A9

Figure 4-9. LSB Troubleshooting Tree

TABLE

Receiver tuned to 15.005 MHz and LED on 1st and 2nd LO not illuminated.
Signal 1 5.00500 MHz, unmodulated @ -40 dBm.

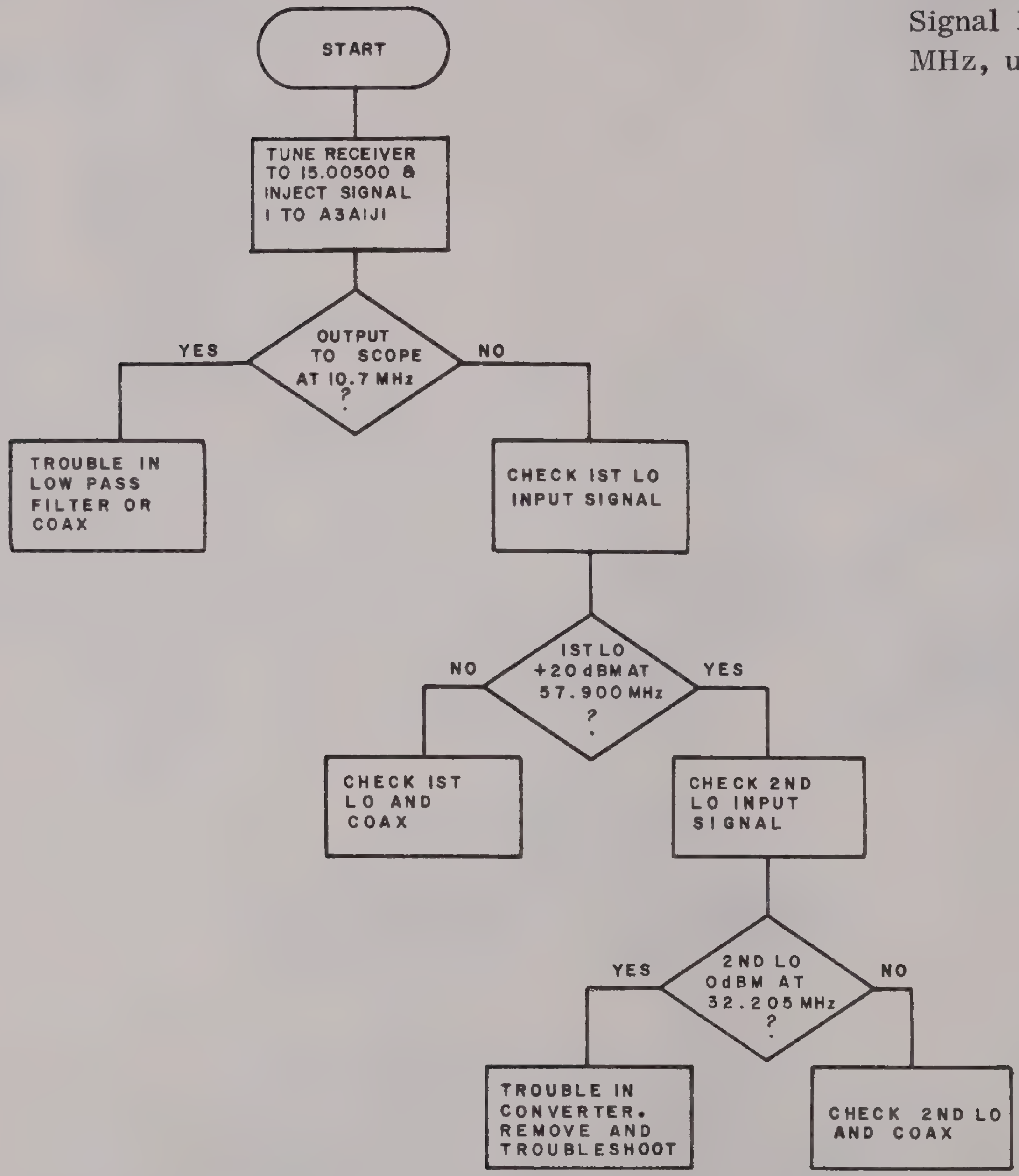
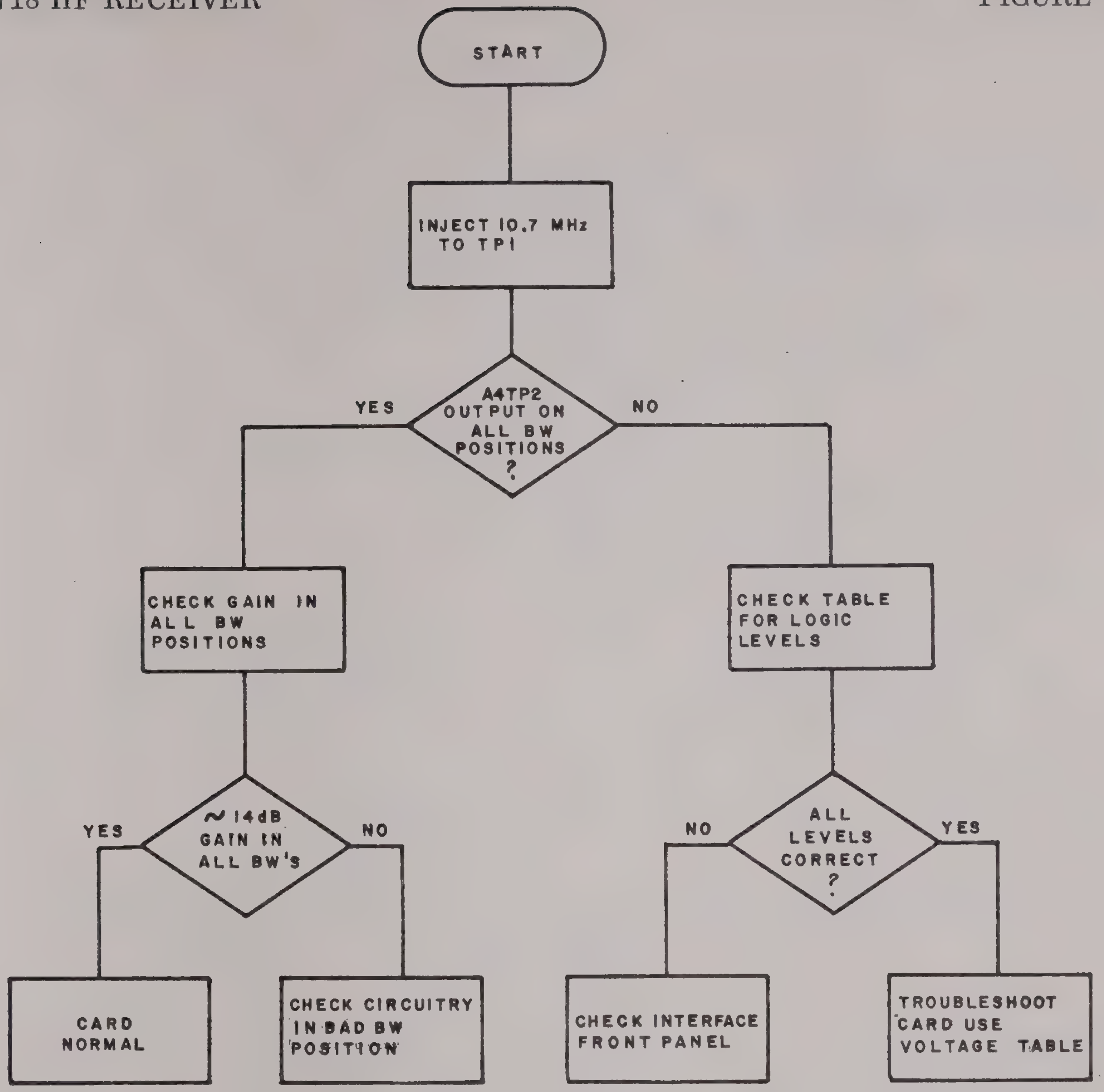

START
TUNE RECEIVER TO 15.00500 & INJECT SIGNAL I TO A3A1J1
OUTPUT TO SCOPE AT 10.7 MHz ?
YES
NO
TROUBLE IN LOW PASS FILTER OR COAX
CHECK 1ST LO INPUT SIGNAL
1ST LO +20 dBM AT 57.900 MHz ?
NO
YES
CHECK 1ST LO AND COAX
CHECK 2ND LO INPUT SIGNAL
2ND LO 0dBM AT 32.205 MHz ?
YES
NO
TROUBLE IN CONVERTER. REMOVE AND TROUBLESHOOT
CHECK 2ND LO AND COAX

Figure 4-10. Input Converter Troubleshooting Tree


START
INJECT 10.7 MHz TO TP1
A4TP2 OUTPUT ON ALL BW POSITIONS ?
YES
NO
CHECK GAIN IN ALL BW POSITIONS
CHECK TABLE FOR LOGIC LEVELS
~ 14dB GAIN IN ALL BW'S
YES
NO
ALL LEVELS CORRECT ?
NO
YES
CARD NORMAL
CHECK CIRCUITRY IN BAD BW POSITION
CHECK INTERFACE FRONT PANEL
TROUBLESHOOT CARD USE VOLTAGE TABLE

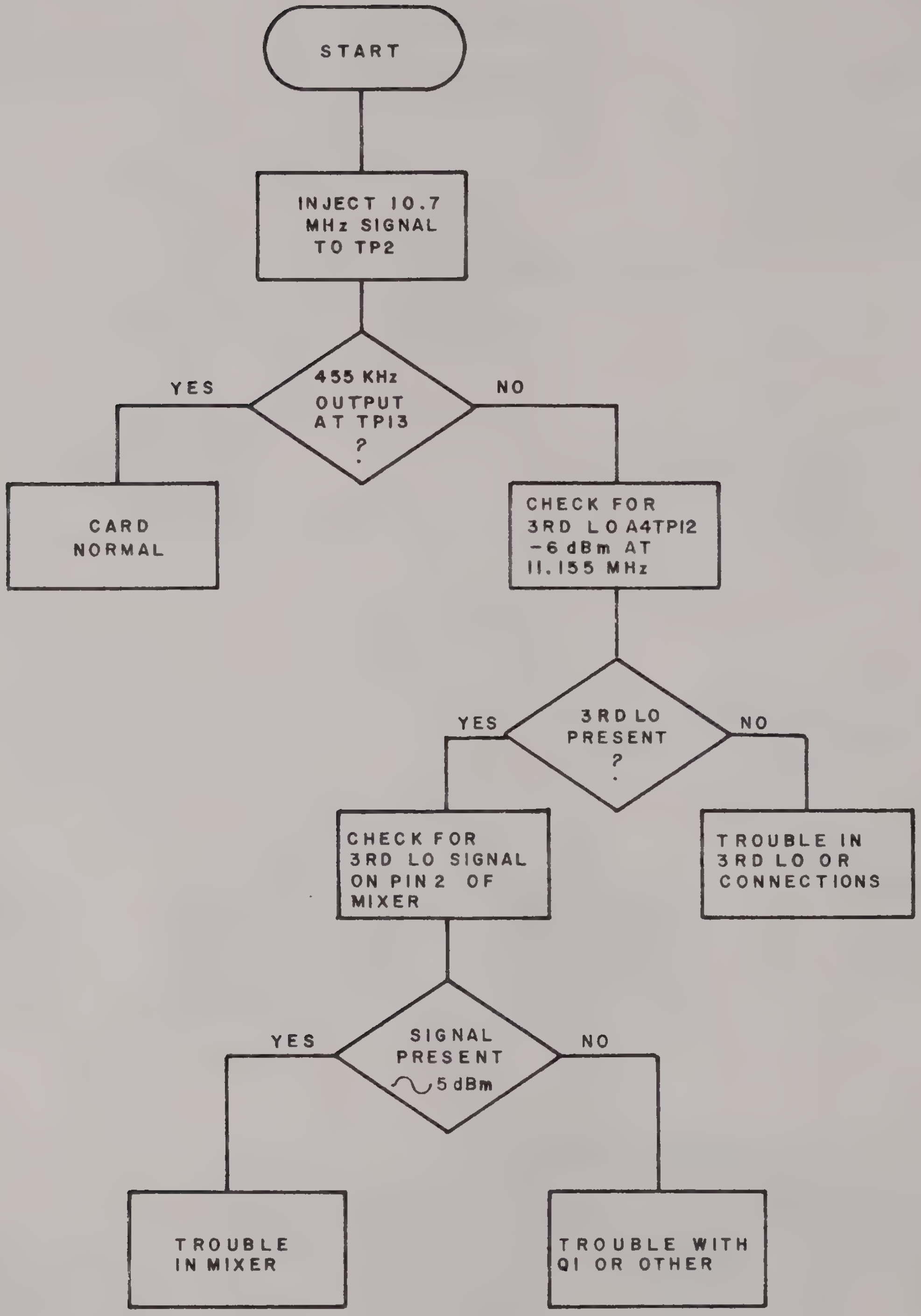
VOLTAGE CHART (Nom)

BANDWIDTHS (kHz)					BANDWIDTHS (kHz)				
	PIN	16	6.0	3.2		PIN	16	6.0	3.2
Q1	1	14.7	14.7	14.4	Q4	1	14.9	14.8	14.9
	2	0	0	4.6		2	0	4.6	0
	3	1.0	1.0	1.4		3	.94	0.8	.94
	4	1.1	1.1	1.9		4	1.4	1.99	1.4
Q2	1	14.9	14.9	14.8	Q5	1	14.7	14.7	14.7
	2	0	0	4.6		2	4.3	0	0
	3	1.0	1.0	0.6		3	0.9	1.0	1.0
	4	1.4	1.4	1.4		4	1.1	1.0	1.0
Q3	1	14.8	14.6	14.8	Q6	1	14.8	14.9	14.9
	2	0	4.6	0		2	4.4	0	0
	3	0.9	1.0	0.9		3	.75	1.0	1.0
	4	0.9	1.4	0.9		4	.76	1.0	1.0

LOGIC SIGNAL CHART

	BANDWIDTHS (kHz)				
	16	6.0	3.2	1.0	0.3
PIN 15	+5	0	0	+5	+5
PIN 17	0	+5	0	0	0
PIN 19	0	0	+5	0	0

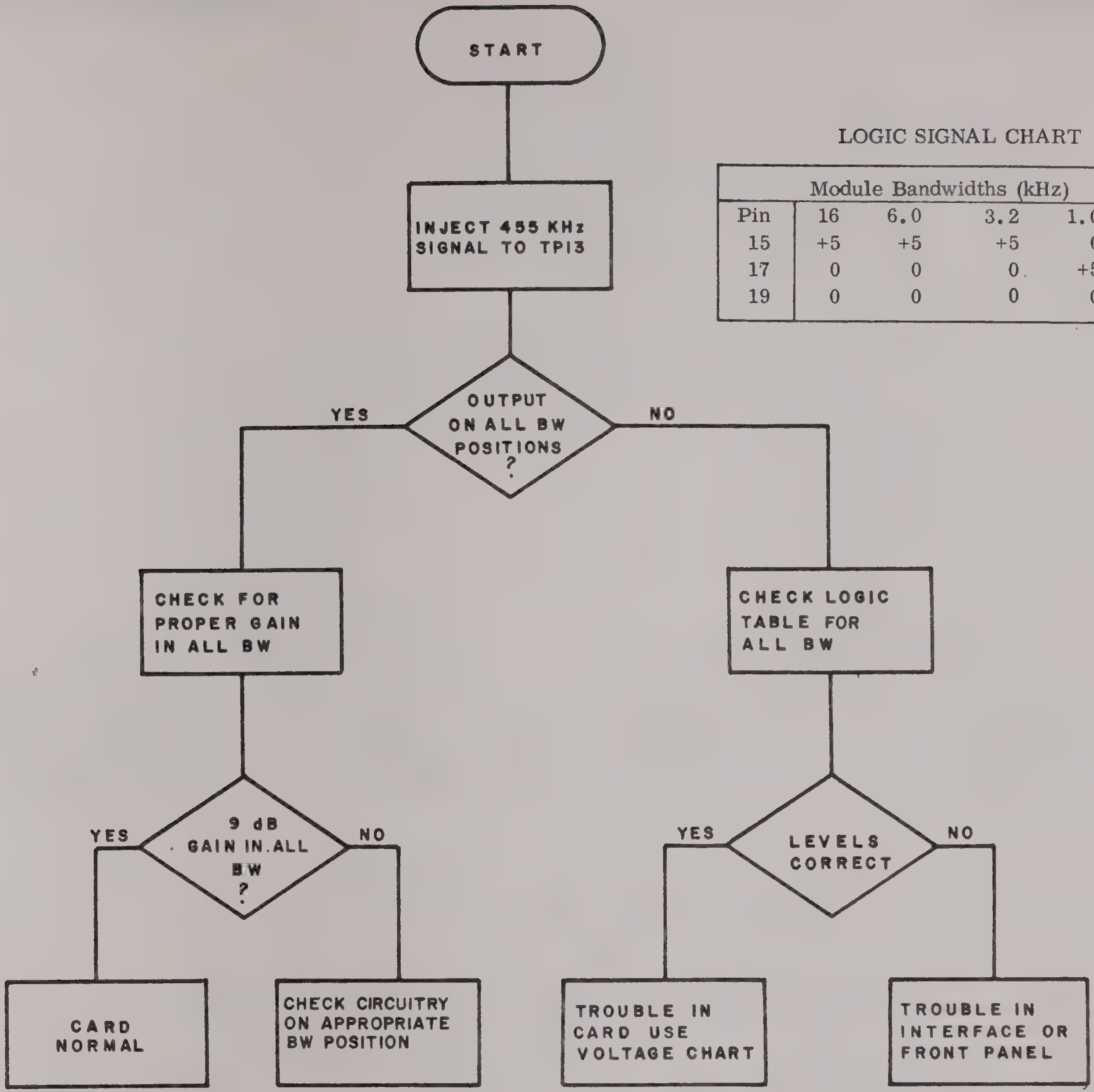
Figure 4-11. 10.7 MHz Filter Switch, A4A1, Troubleshooting Tree


START
INJECT 10.7 MHz SIGNAL TO TP2
455 KHz OUTPUT AT TP13 ?
YES
NO
CARD NORMAL
CHECK FOR 3RD LO A4TP12 -6 dBm AT 11.155 MHz
3RD LO PRESENT ?
YES
NO
CHECK FOR 3RD LO SIGNAL ON PIN 2 OF MIXER
TROUBLE IN 3RD LO OR CONNECTIONS
SIGNAL PRESENT ∼5 dBm
YES
NO
TROUBLE IN MIXER
TROUBLE WITH Q1 OR OTHER

VOLTAGE LEVEL (Nom)

Q1	EMITTER	+3.24
	BASE	+3.96
	COLLECTOR	+14.8

Figure 4-12. 10.7 MHz/455 kHz Converter, A4A2, Troubleshooting Tree


START
INJECT 455 KHz SIGNAL TO TP13
OUTPUT ON ALL BW POSITIONS ?
YES
NO
CHECK FOR PROPER GAIN IN ALL BW
CHECK LOGIC TABLE FOR ALL BW
9 dB GAIN IN ALL BW ?
YES
NO
LEVELS CORRECT
YES
NO
CARD NORMAL
CHECK CIRCUITRY ON APPROPRIATE BW POSITION
TROUBLE IN CARD USE VOLTAGE CHART
TROUBLE IN INTERFACE OR FRONT PANEL

LOGIC SIGNAL CHART

	Module Bandwidths (kHz)				
Pin	16	6.0	3.2	1.0	0.3
15	+5	+5	+5	0	0
17	0	0	0	+5	0
19	0	0	0	0	+5

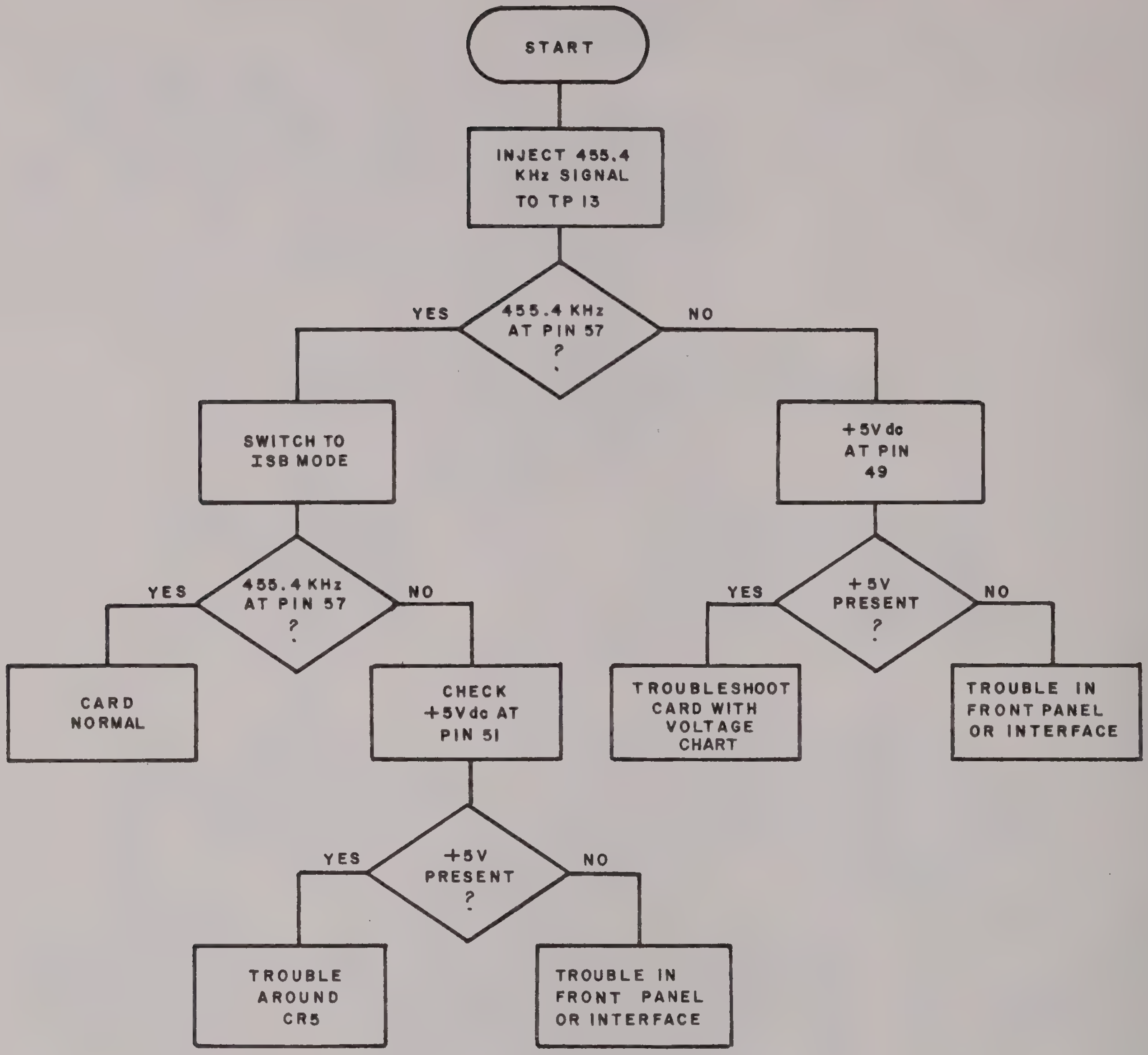
U1 VOLTAGES (Nom)

	16 BW(kHz)		
	6/3.2	1.0	0.3
PIN 1	-12.9	+13.5	-12.9
3	0	+4.6	0
5	+4.4	0	0
7	+13.6	-13	-13
11	-14	-14	-14
12	0	0	+4.6
13	+2.7	+2.7	+2.7
14	-13	-13	+13.6

TRANSISTOR VOLTAGES (Nom)

		16 BW(kHz)					16 BW(kHz)		
		6/3.2	1.0	0.3			6/3.2	1.0	0.3
Q1	E	0	0	1.3	Q4	E	0	.8	0
	B	-1.8	-1.8	+1.8		B	-1.4	+1.4	-1.4
	C	14.9	14.9	14.9		C	14	14	14
Q2	E	0	0	0.9	Q5	E	1.25	0	0
	B	-1.5	-1.5	+1.5		B	+1.9	-1.9	-1.9
	C	14	14	14		C	14.7	14.7	14.7
Q3	E	0	2.3	0	Q6	E	+.8	0	0
	B	-3	+3	-3		B	+1.4	-1.4	-1.4
	C	14.9	14.3	14.8		C	+14	14	14

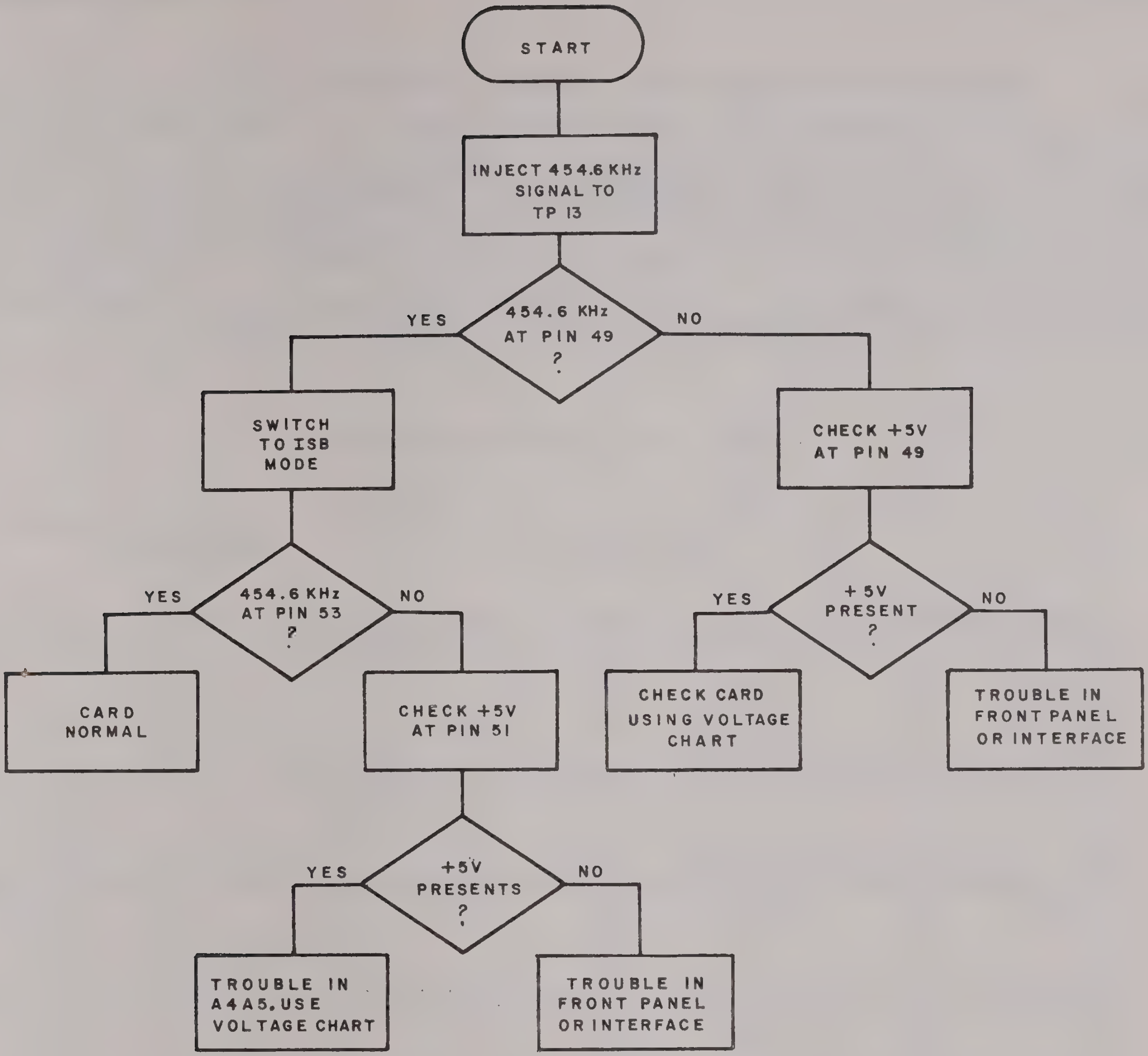
Figure 4-13. 455 kHz Filter Switch, A4A3, Troubleshooting Tree


START
INJECT 455.4 KHz SIGNAL TO TP 13
455.4 KHz AT PIN 57 ?
YES
NO
SWITCH TO ISB MODE
+5V dc AT PIN 49
455.4 KHz AT PIN 57 ?
YES
NO
+5V PRESENT ?
YES
NO
CARD NORMAL
CHECK +5Vdc AT PIN 51
TROUBLESHOOT CARD WITH VOLTAGE CHART
TROUBLE IN FRONT PANEL OR INTERFACE
+5V PRESENT ?
YES
NO
TROUBLE AROUND CR5
TROUBLE IN FRONT PANEL OR INTERFACE

TRANSISTOR VOLTAGE CHART

		USB MODE ACTIVE	OTHER MODES ACTIVE
Q1	1	+14.5	+15.1
	2	+4.2	0
	3	+2.0	+2.0
	4	+2.7	+2.0
Q2	1	+14.6	+15.1
	2	+4.3	0.0
	3	+1.7	+1.4
	4	+3.2	+2.0

Figure 4-14. USB Filter Switch, A4A4, Troubleshooting Tree


START
INJECT 454.6 KHz SIGNAL TO TP 13
454.6 KHz AT PIN 49 ?
YES
NO
SWITCH TO ISB MODE
CHECK +5V AT PIN 49
454.6 KHz AT PIN 53 ?
YES
NO
+5V PRESENT ?
YES
NO
CARD NORMAL
CHECK +5V AT PIN 51
CHECK CARD USING VOLTAGE CHART
TROUBLE IN FRONT PANEL OR INTERFACE
+5V PRESENTS ?
YES
NO
TROUBLE IN A4A5, USE VOLTAGE CHART
TROUBLE IN FRONT PANEL OR INTERFACE

Voltage Chart (nom)

Detection Mode									
		LSB	ISB	OTHER			LSB	ISB	OTHER
Q1	1	14.4	14.4	15.1	Q3	1	15.1	14.7	15.1
	2	4.2	4.2	0		2	0	4.2	0
	3	2.2	2.2	2.0		3	1.4	1.6	1.4
	4	2.7	2.7	2.0		4	2.0	2.8	2.0
Q2	1	14.6	15.1	15.1					
	2	4.2	0	0					
	3	1.6	1.3	1.3					
	4	2.9	2.0	2.0					

Figure 4-15. ISB/LSB Filter Switch, A4A5, Troubleshooting Tree

Because of the nature of AGC circuits, the following voltage charts are provided for troubleshooting. Two sets of data are given: one within a input signal and one without. When using the input signal data, tune the receiver to 15.00500 MHz and inject an unmodulated signal of 15.00500 MHz at -50 dBm into RF input jack A2J1. Nominal voltage values are given for each of the three gain modes: Manual, Fast AGC, and Slow AGC. The RF Gain Control must be set maximum clockwise while using Manual Mode No Signal data. To use data for Manual Mode with Input Signal, reduce gain control setting to achieve the same meter reading as in AGC Mode.

Table 4-4a. AGC Voltage Chart

		INPUT SIGNAL			NO SIGNAL		
TRANSISTOR		MAN	SLOW	FAST	MAN	SLOW	FAST
Q1	E	1.7	2.2	2.2	.05	.06	.06
	B	2.0	2.6	2.6	+.4	.38	.38
	C	14.3	14.3	14.4	14.4	14.3	14.4
Q2	E	.77	.77	.77	.06	.06	.06
	B	.18	.20	.20	.02	0.2	.02
	C	0.0	.13	.13	0.0	0.0	0.0
Q3	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	0.6	0.0	0.0	.59	0.0	0.0
	C	0.0	0.0	0.0	.01	0.0	0.0
Q4	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	-2.3	-2.3	-2.3	-2.3	-2.3	-2.3
	C	-.06	-.06	-.06	0.0	0.0	0.0
Q5	E	-2.9	-2.8	-2.8	-.50	.07	.07
	B	-2.3	-2.3	-2.3	-2.3	-2.3	-2.3
	C	-.06	-.06	-.06	0.0	0.0	0.0
Q6	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	.58	0.0	0.0	.54	0.0	0.0
	C	.05	.13	.13	.01	0.0	0.0
Q7	E	0.0	0.0	0.0	0.0	0.0	0.0
	B	-3.9	.62	-3.9	-3.9	.63	-3.9
	C	N/A	N/A	N/A	N/A	N/A	N/A

Table 4-4b. AGC Voltage Chart

IC PIN		INPUT SIGNAL			NO SIGNAL		
		MAN	SLOW	FAST	MAN	SLOW	FAST
U1	1	2.0	2.2	2.2	.06	.07	.07
	2	2.0	2.2	2.2	.06	.07	.07
	3	2.0	2.2	2.2	.05	.06	.05
	4	14.3	14.3	14.4	14.4	14.3	14.4
	5	0.0	5.0	0.0	0.0	5.0	0.0
	6	1.5	1.7	1.7	1.7	1.7	1.7
	7	-12.6	12.9	-12.6	-12.9	12.9	-12.6
	8	-2.0	-2.2	-2.2	-.05	-.05	-.05
	9	0.0	0.0	0.0	0.0	0.0	0.0
	10	0.0	0.0	0.0	0.0	0.0	0.0
	11	-13.8	-13.8	-13.8	-13.8	-13.9	-13.8
	12	-3.6	-3.6	-3.6	-.5	.07	.07
	13	-3.6	-3.6	-3.6	-.5	.07	.07
	14	-3.6	-3.6	-3.6	-.5	.07	.07
U2	1	.86	.82	.83	-.08	-.08	-.08
	2	.86	.82	.83	-.08	-.08	-.08
	3	.86	.82	.83	-.08	-.08	-.08
	4	14.3	14.3	14.4	14.4	14.3	14.3
	5	0.0	0.0	0.0	0.0	0.0	0.0
	6	0.0	0.0	0.0	0.0	0.0	0.0
	7	-6.6	-6.5	-6.5	-.8	.12	.12
	8	-.25	-.24	-.24	.03	.03	.03
	9	-.05	-.06	-.06	0.0	0.0	0.0
	10	-.06	-.06	-.06	0.0	0.0	0.0
	11	-13.8	-13.8	-13.8	-13.8	-13.9	-13.8
	12	0.0	0.0	0.0	0.0	0.0	0.0
	13	0.0	0.0	0.0	0.0	0.0	0.0
	14	.85	.82	.8	0.0	0.0	0.0

CARD A4A7 TROUBLESHOOTING CHART

This card, the 455 kHz Amplifier/AM Detector, is tested below using voltage levels. Nominal values of each transistor are given below and should be used in conjunction with the circuit description given in Section 3.2.10. The only requirement when using the voltage levels below is that the receiver be in the FAST AGC mode and no RF input signal.

Table 4-5. 455 kHz Amp/AM Detector Voltage Chart

TRANSISTOR PIN		VOLTAGE	TRANSISTOR PIN		VOLTAGE
Q1	1	13.7	Q4	E	3.5
	2	3.75		B	4.1
	3	0.87		C	14.4
	4	1.60			
Q2	1	15.0	Q5	E	-0.7
	2	3.80		B	-0.1
	3	0.9		C	14.2
	4	1.4			
Q3	E	-0.5	Q6	E	3.3
	B	0.0		B	.95
	C	15.0		C	15.0

SIGNAL

Signal 1	454.6 kHz unmodulated signal @-55 dBm
Signal 2	454.6 kHz unmodulated signal @ -20 dBm
Signal 3	400 Hz audio @ 100 m Vrms

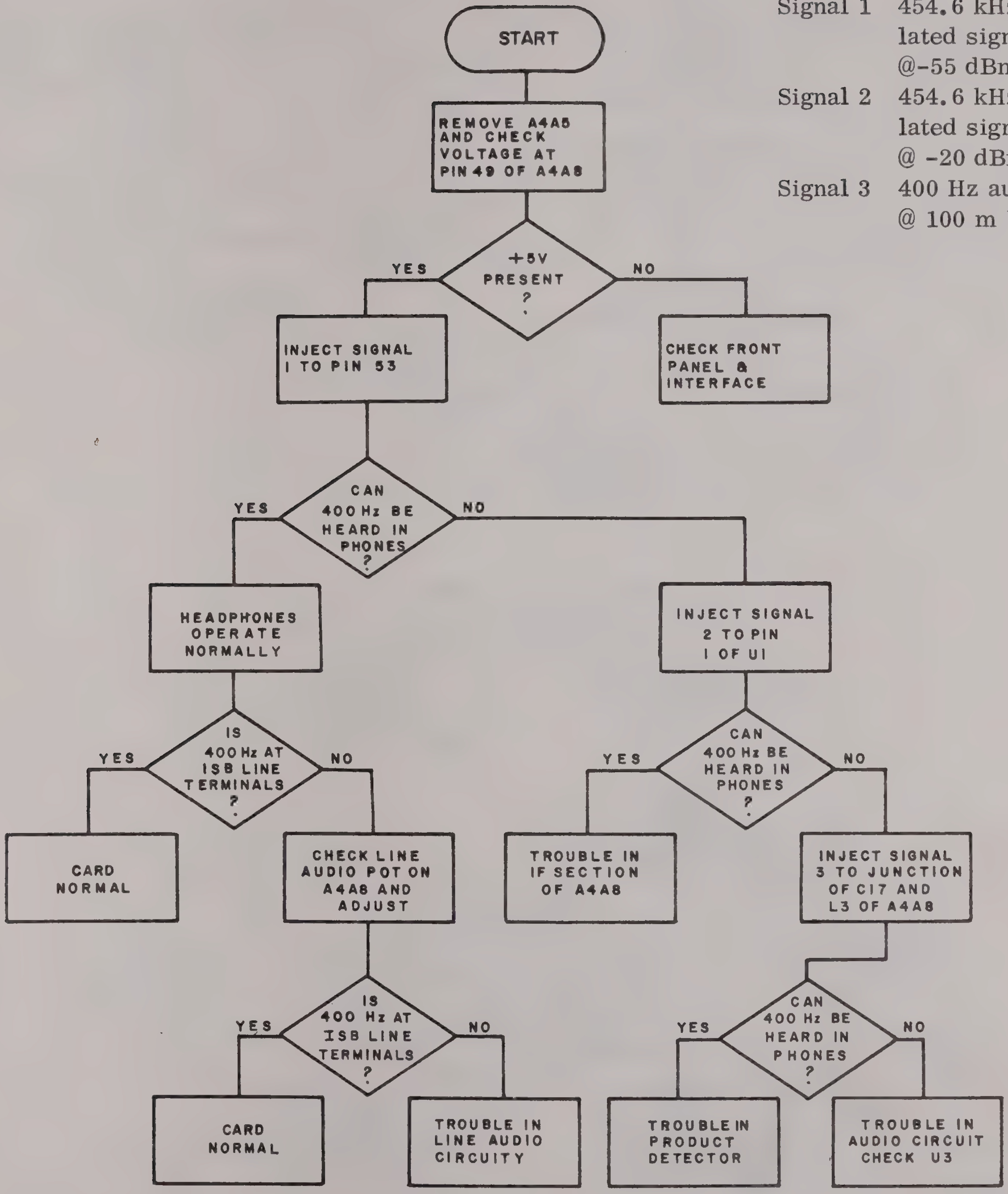

START
REMOVE A4A5 AND CHECK VOLTAGE AT PIN 49 OF A4A8
+5V PRESENT ?
YES
NO
INJECT SIGNAL I TO PIN 53
CHECK FRONT PANEL & INTERFACE
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
HEADPHONES OPERATE NORMALLY
INJECT SIGNAL 2 TO PIN I OF UI
IS 400 Hz AT ISB LINE TERMINALS ?
YES
NO
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CARD NORMAL
CHECK LINE AUDIO POT ON A4A8 AND ADJUST
TROUBLE IN IF SECTION OF A4A8
INJECT SIGNAL 3 TO JUNCTION OF C17 AND L3 OF A4A8
IS 400 Hz AT ISB LINE TERMINALS ?
YES
NO
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CARD NORMAL
TROUBLE IN LINE AUDIO CIRCUITY
TROUBLE IN PRODUCT DETECTOR
TROUBLE IN AUDIO CIRCUIT CHECK U3

Figure 4-16. ISB Detector/Audio, A4A8, Troubleshooting Tree

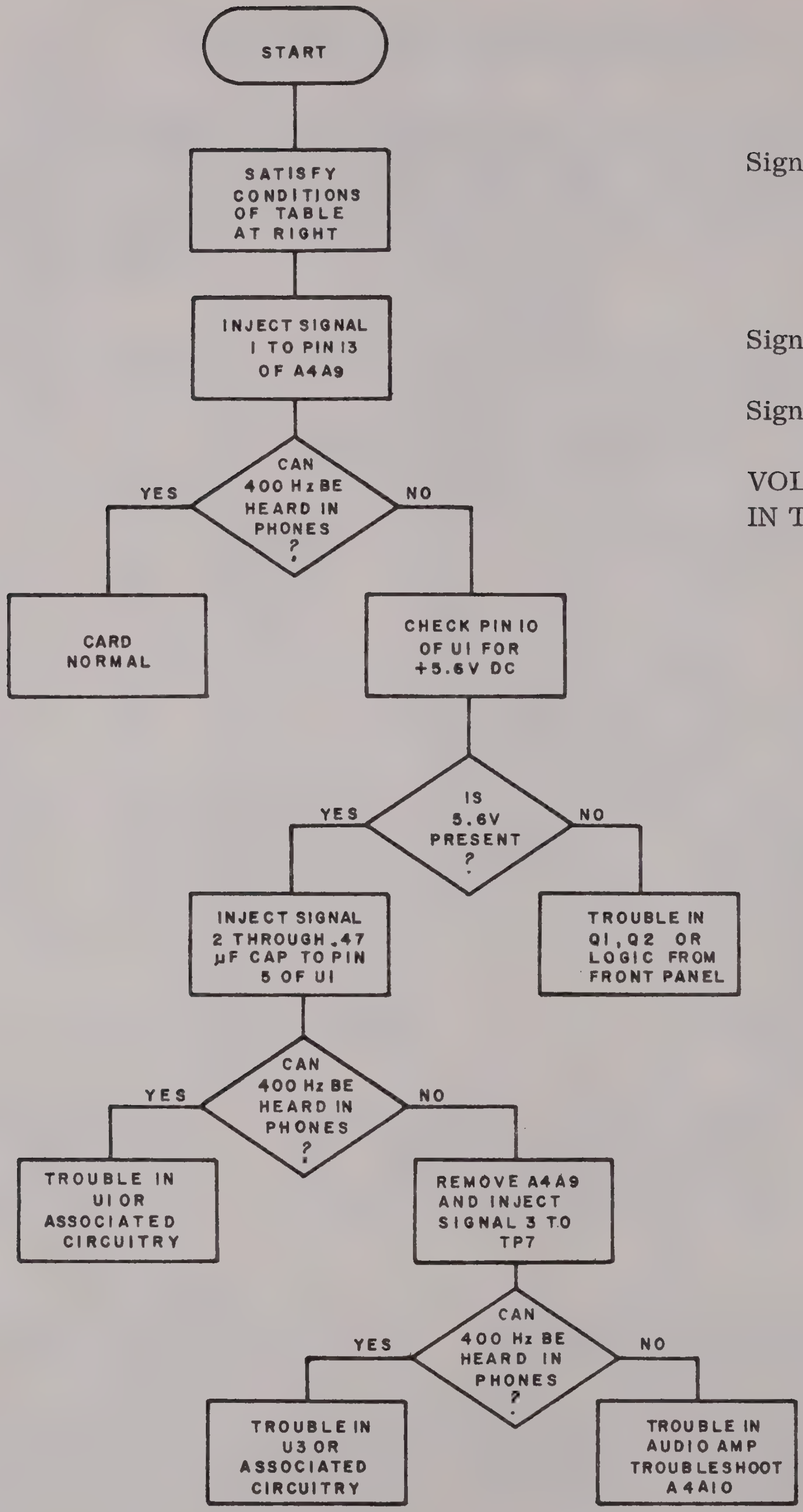

START
SATISFY CONDITIONS OF TABLE AT RIGHT
INJECT SIGNAL 1 TO PIN 13 OF A4A9
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CARD NORMAL
CHECK PIN 10 OF U1 FOR +5.6V DC
IS 5.6V PRESENT ?
YES
NO
INJECT SIGNAL 2 THROUGH .47 μF CAP TO PIN 5 OF U1
TROUBLE IN Q1, Q2 OR LOGIC FROM FRONT PANEL
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
TROUBLE IN U1 OR ASSOCIATED CIRCUITRY
REMOVE A4A9 AND INJECT SIGNAL 3 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
TROUBLE IN U3 OR ASSOCIATED CIRCUITRY
TROUBLE IN AUDIO AMP TROUBLESHOOT A4A10

Figure 4-17. Detector, A4A9, Troubleshooting Tree, FM Portion

SIGNALS

Signal 1	455 kHz FM unmodulated by 400 Hz with a deviation of 4 kHz @-37 dBm
Signal 2	Same as Signal 1 with +15 dBm
Signal 3	400 Hz Audio @ 0.8 Vrms

VOLTAGE LEVELS IN TABLE 4-6

SIGNALS

Signal 1	455 kHz FM Unmodulated @-28 dBm
Signal 2	400 Hz Audio @ 70m Vrms
Signal 3	400 Hz Audio @ 800m Vrms

VOLTAGE LEVELS IN TABLE 4-6

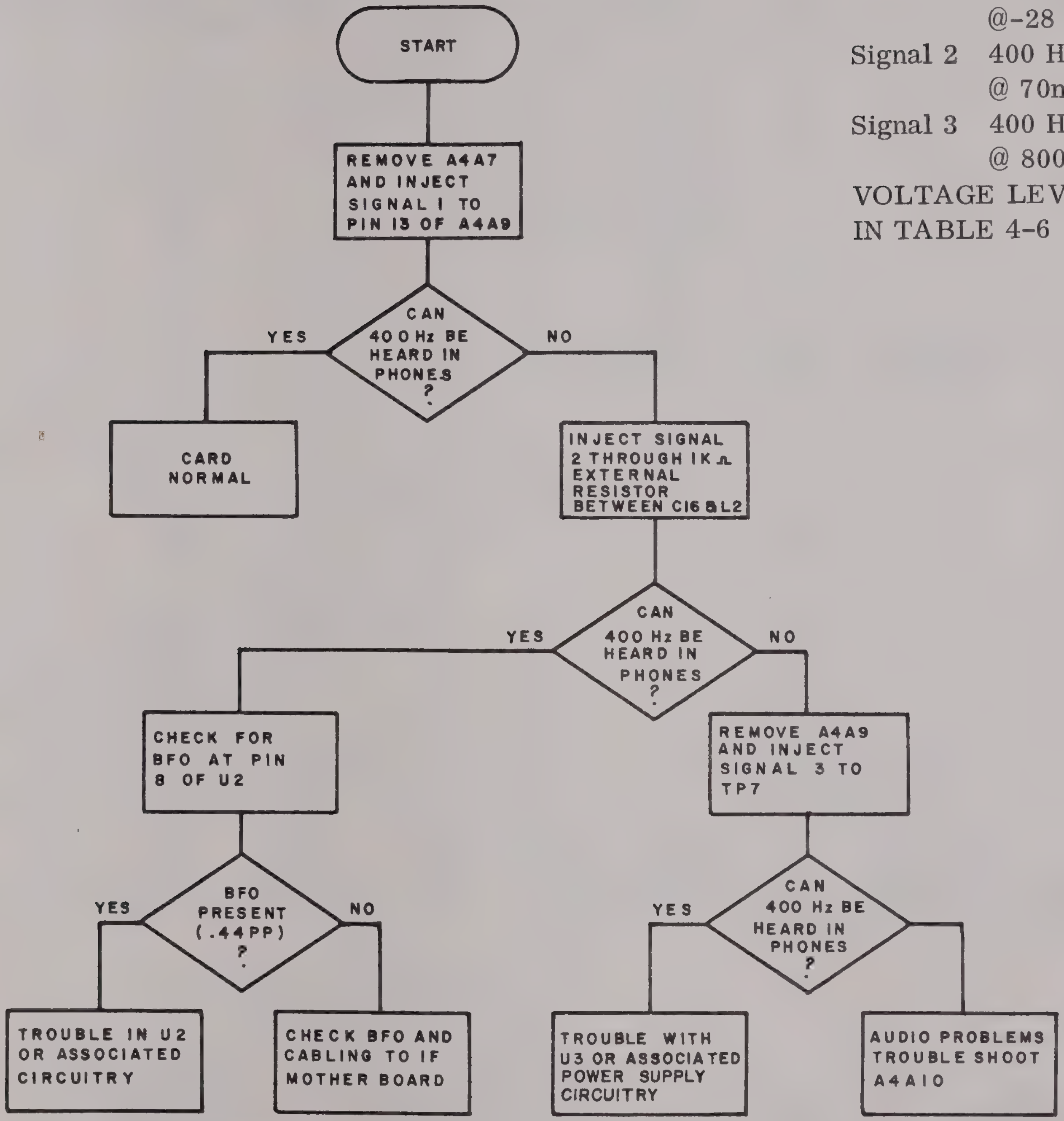

START
REMOVE A4A7 AND INJECT SIGNAL 1 TO PIN 13 OF A4A9
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CARD NORMAL
INJECT SIGNAL 2 THROUGH 1K Ω EXTERNAL RESISTOR BETWEEN C16 & L2
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CHECK FOR BFO AT PIN 8 OF U2
REMOVE A4A9 AND INJECT SIGNAL 3 TO TP7
BFO PRESENT (.44PP) ?
YES
NO
CAN 400 Hz BE HEARD IN PHONES ?
YES
TROUBLE IN U2 OR ASSOCIATED CIRCUITRY
CHECK BFO AND CABLING TO IF MOTHER BOARD
TROUBLE WITH U3 OR ASSOCIATED POWER SUPPLY CIRCUITRY
AUDIO PROBLEMS TROUBLE SHOOT A4A10

Figure 4-18. Detector, A4A9, Troubleshooting Tree, CW/SSB Portion

Table 4-6. FM, CW, and SSB Detector Voltage Chart

COMPONENT PIN	AM	FM	CW & SB	COMPONENT PIN	AM	FM	CW & SB
Q1 E	9.6	8.1	9.2	U2 3	-1.7	-1.7	-1.7
Q1 B	9.5	7.3	9.2	U2 4	-1.6	-1.6	-1.6
Q1 C	0.0	8.0	0.0	U2 5	-3.8	-3.8	-3.8
Q2 E	0.0	2.0	0.0	U2 6	-0.7	-0.7	3.8
Q2 B	0.0	.62	0.0	U2 7	0.0	0.0	0.0
Q2 C	9.9	0.0	9.2	U2 8	-0.1	-0.1	0.0
Q3 E	9.6	8.7	9.0	U2 9	-0.0	0.0	0.0
Q3 B	9.6	8.7	8.4	U2 12	-0.7	-0.7	4.0
Q3 C	-1.8	-1.8	9.0	U2 13	-0.7	-0.7	4.0
Q4 E	0.0	0.0	0.0	U2 14	-13.0	-13.0	-13.0
Q4 B	0.0	0.0	0.7	U3 1	0.0	.63	0.0
Q4 C	9.6	8.8	0.0	U3 2	0.0	.63	0.0
U1 1	0.0	2.0	0.0	U3 3	0.0	.64	0.0
U1 2	0.0	2.0	0.0	U3 4	14.0	12.5	13.5
U1 3	0.0	2.0	0.0	U3 5	0.0	0.0	0.0
U1 4	0.0	2.0	0.0	U3 6	0.0	0.0	0.0
U1 5	0.0	5.6	0.0	U3 7	0.0	0.0	0.0
U1 6	0.0	0.0	0.0	U3 8	0.0	-0.6	0.0
U1 7	0.0	0.0	0.0	U3 9	0.0	0.0	0.0
U1 8	0.0	0.0	0.0	U3 10	0.0	0.0	0.0
U1 9	0.0	0.8	0.0	U3 11	-13.0	-13.0	-13.0
U1 10	0.0	5.6	0.0	U3 12	9.4	8.5	9.1
U2 1	-1.6	-1.6	-1.6	U3 13	9.4	8.5	9.1
U2 2	-1.7	-1.7	-1.7	U3 14	9.4	8.5	9.1

SIGNAL

Signal 1 400 Hz Audio
@ 0.7 Vrms

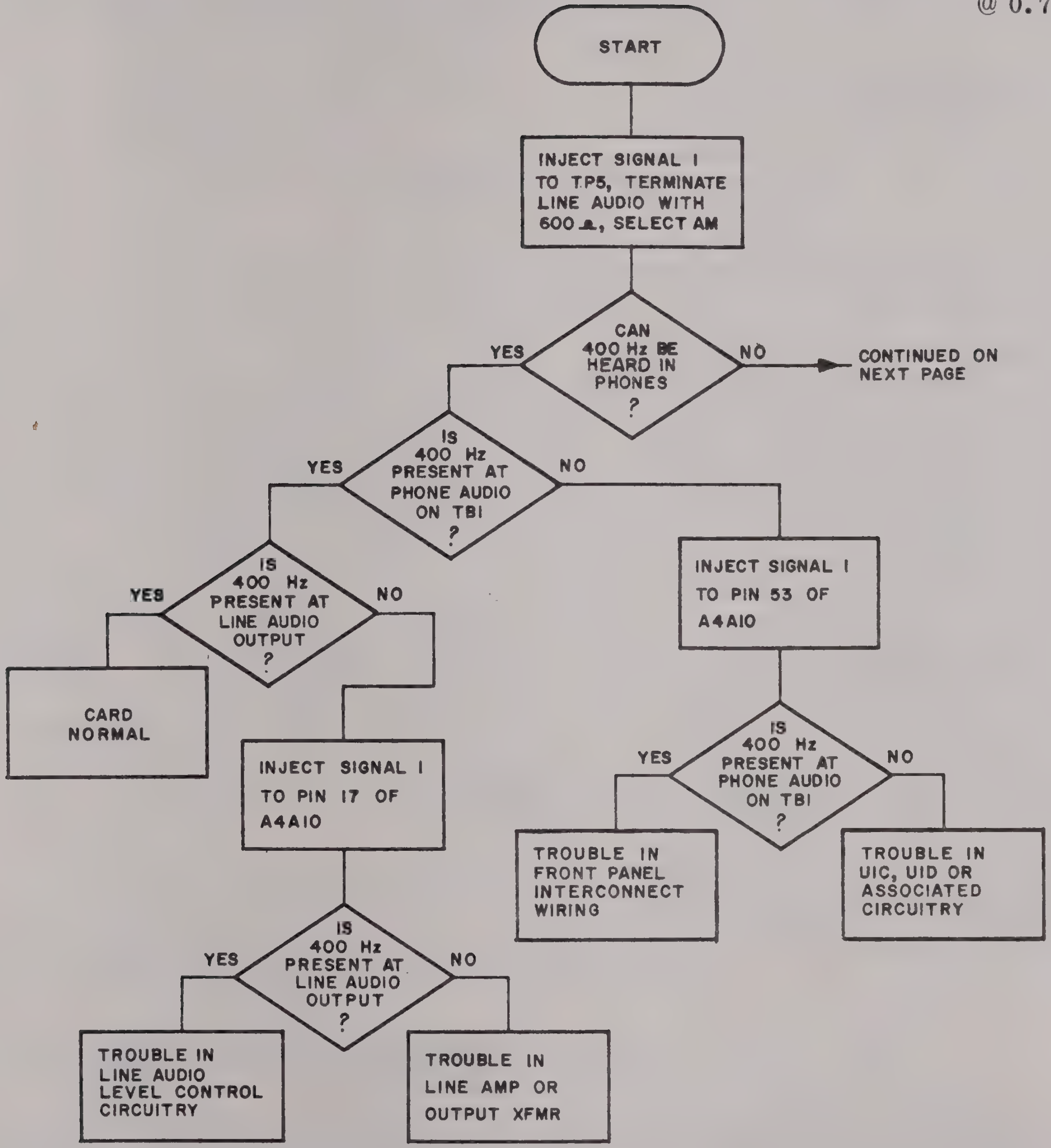

START
INJECT SIGNAL 1 TO TP5, TERMINATE LINE AUDIO WITH 600 Ω, SELECT AM
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
CONTINUED ON NEXT PAGE
IS 400 Hz PRESENT AT PHONE AUDIO ON TB1 ?
YES
NO
IS 400 Hz PRESENT AT LINE AUDIO OUTPUT ?
YES
NO
CARD NORMAL
INJECT SIGNAL 1 TO PIN 17 OF A4A10
IS 400 Hz PRESENT AT LINE AUDIO OUTPUT ?
YES
NO
TROUBLE IN LINE AUDIO LEVEL CONTROL CIRCUITRY
TROUBLE IN LINE AMP OR OUTPUT XFMR
INJECT SIGNAL 1 TO PIN 53 OF A4A10
IS 400 Hz PRESENT AT PHONE AUDIO ON TB1 ?
YES
NO
TROUBLE IN FRONT PANEL INTERCONNECT WIRING
TROUBLE IN UIC, UID OR ASSOCIATED CIRCUITRY

Figure 4-19a. Audio Amplifier, A4A10, Troubleshooting Tree

SIGNALS

Signal 1 400 Hz Audio @ 0.7 Vrms

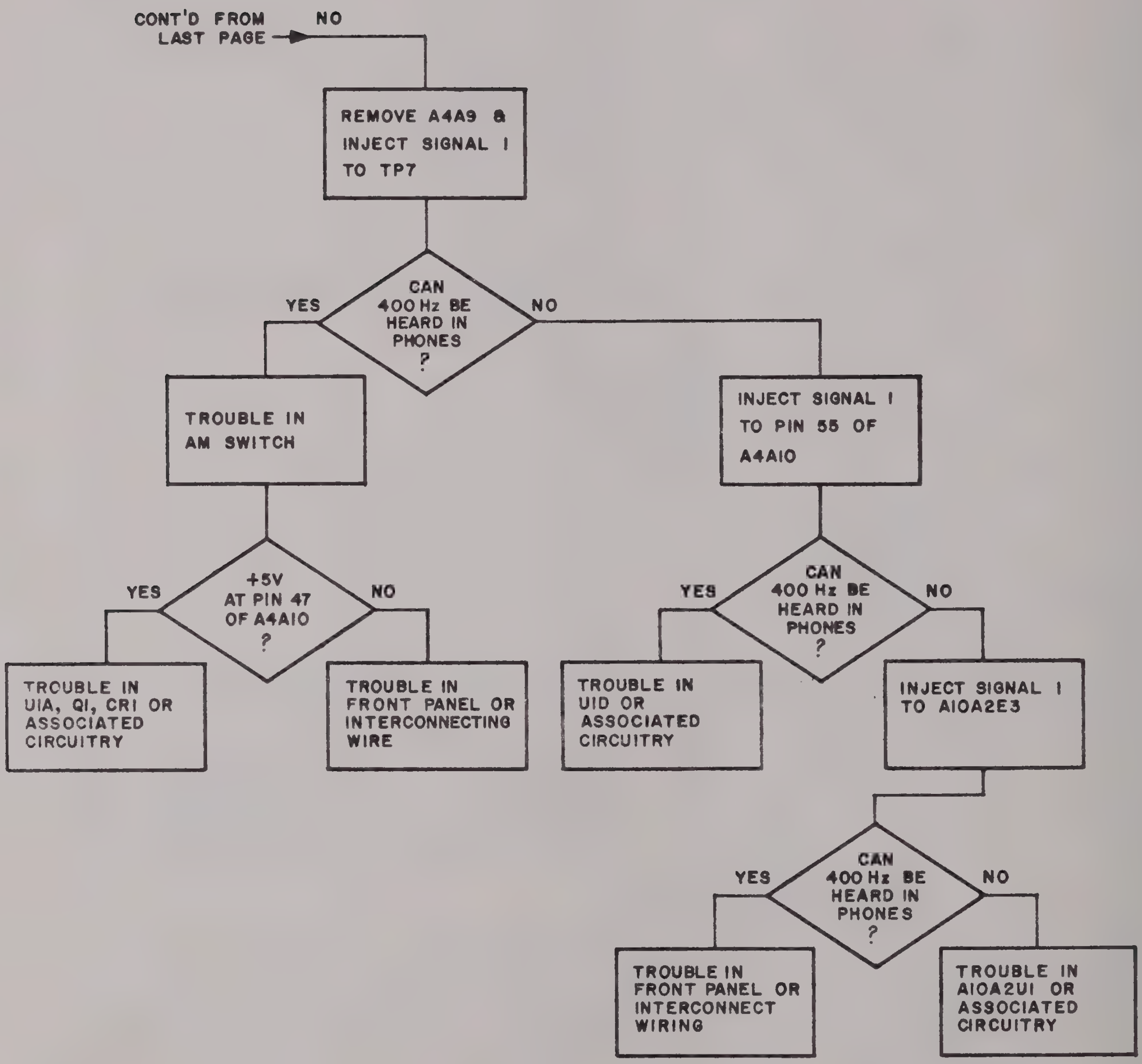

CONT'D FROM LAST PAGE
NO
REMOVE A4A9 & INJECT SIGNAL 1 TO TP7
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
TROUBLE IN AM SWITCH
INJECT SIGNAL 1 TO PIN 55 OF A4A10
+5V AT PIN 47 OF A4A10 ?
YES
NO
TROUBLE IN U1A, Q1, CR1 OR ASSOCIATED CIRCUITRY
TROUBLE IN FRONT PANEL OR INTERCONNECTING WIRE
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
TROUBLE IN U1D OR ASSOCIATED CIRCUITRY
INJECT SIGNAL 1 TO A10A2E3
CAN 400 Hz BE HEARD IN PHONES ?
YES
NO
TROUBLE IN FRONT PANEL OR INTERCONNECT WIRING
TROUBLE IN A10A2U1 OR ASSOCIATED CIRCUITRY

Figure 4-19b. Audio Amplifier, A4A10, Troubleshooting Tree

4.7.3 DIGITAL SECTION TROUBLESHOOTING PROCEDURE

The digital section is comprised of the following circuit cards:

Manual Tuning Up/Down Counter (A6A1)
Front Panel Interface (A6A2)
Manual Control Module (A7)
Frequency Display (A8)
BFO Switch (A9)
Upper Panel Control (A10A1)
Lower Panel Control (A10A2)

It is suggested that troubleshooting of the digital section be carried out using a dual or four-trace oscilloscope. The complexity of the circuitry renders it essential that the technician be familiar with the functional and circuit descriptions given in Section III of this manual. Occasionally, the main circuit causing the trouble can be pinpointed by noting that the symptom occurs only for operating modes which involve a certain circuit. On the other hand, symptoms which occur for several operating modes would tend to lead the troubleshooter to circuitry which is active for all these modes. If it is found that a specific circuit is not performing correctly, check that it is receiving the proper inputs and then continue step-by-step with signal and voltage checks, using the circuit descriptions and schematic diagrams as a guide, until the trouble is found. It may be helpful to refer to the receiver section troubleshooting diagrams. At the beginning of each test are digital control voltages needed to complete the test. Also a circuit card dependency diagram is shown at the beginning of this section, Figure 4-1.

4.7.4 SYNTHESIZER SECTION TROUBLESHOOTING PROCEDURE

The synthesizer section troubleshooting procedure contains an independent test of each of the following boards: 1st LO, 1st LO VCO, 2nd LO, 3rd LO, BFO, and the Time Base Circuits. It is recommended to read the circuit descriptions of a particular board when a trouble has been isolated.

4.7.4.1 1st LO Synthesizer Troubleshooting Test

Troubleshooting the 1st LO is required when the 1st LO output, which enters the divider circuits from the VCO through Jack J1, does not vary between 171.64 to 291.60 MHz.

1. VCO Band Select Circuitry - Table 4-7 below checks for proper operation of U13, diodes CR8 through CR10, and Q1 through Q3, while dialing different frequencies on the front panel.

Table 4-7. VCO Band Select Code

TUNED FREQUENCY	BAND SELECT OUTPUT (Vdc) E3	E2	E1
0.00 - 3.99 MHz	+15	+15	+15
4.00 - 7.99 MHz	+15	+15	-12
8.00 - 11.99 MHz	+15	-12	+15
12.00 - 15.99 MHz	+15	-12	-12
16.00 - 19.99 MHz	-12	+15	+15
20.00 - 23.99 MHz	-12	+15	-12
24.00 - 27.99 MHz	-12	-12	+15
28.00 - 29.99 Mhz	-12	-12	-12

2. Divider Section - With a tuned frequency of 00.00000 MHz, or an input to J1 of 1st and 3rd LO of 171.64 MHz, the following frequencies in Table 4-8 should be found at the corresponding IC pins using a digital counter.

Table 4-8. 1st LO Frequency Chart

IC	PIN	FREQ (Hz)	IC	PIN	FREQ (Hz)
U1	7	17 M	U9	7	1.68 M
U1	9	3.4 M	U9	9	80 K
U1	10	40 K	U9	15	40 K
U2	12	3.4 M	U10	3	840 K
U3	7	40 K	U10	7	200 K
U3	9	40 K	U11	6	40 K
U6	3	40 K	U11	7	40 K
U8	7	340 K	U12	5	40 K
U9	1	40 K	U12	9	40 K

3. Phase Detector U5 - Check for 40 kHz signal at input pin 3 of U5. If signal is not present, troubleshoot Time Base Circuits. Check for 40 kHz signal at pin 1 of U5. If not present, troubleshoot 1st LO counter circuits. Refer to Figure 4-20 to understand the function of the phase detector.

4. 1st LO VCO - The 1st LO VCO is located on the 1st and 3rd LO pc board. It is recommended to read the circuit description of the VCO before troubleshooting (Section 3.3.7.4). The frequency of the oscillator, Q1, is controlled by the band select code and the tuning voltage. The frequency can be determined by multiplying the tuned frequency in Table 4-7 by 4.

a. Roughly a +1 dBm signal enters the base of Q2 with +11 dBm leaving at the collector. A -9 dBm signal enters the base of Q3 and a +1 dBm signal leaves at the collector. A +6 dBm enters the base of Q5 and an approximate +20 dBm leaves the collector. The output at test point E3 is roughly +20 dBm.

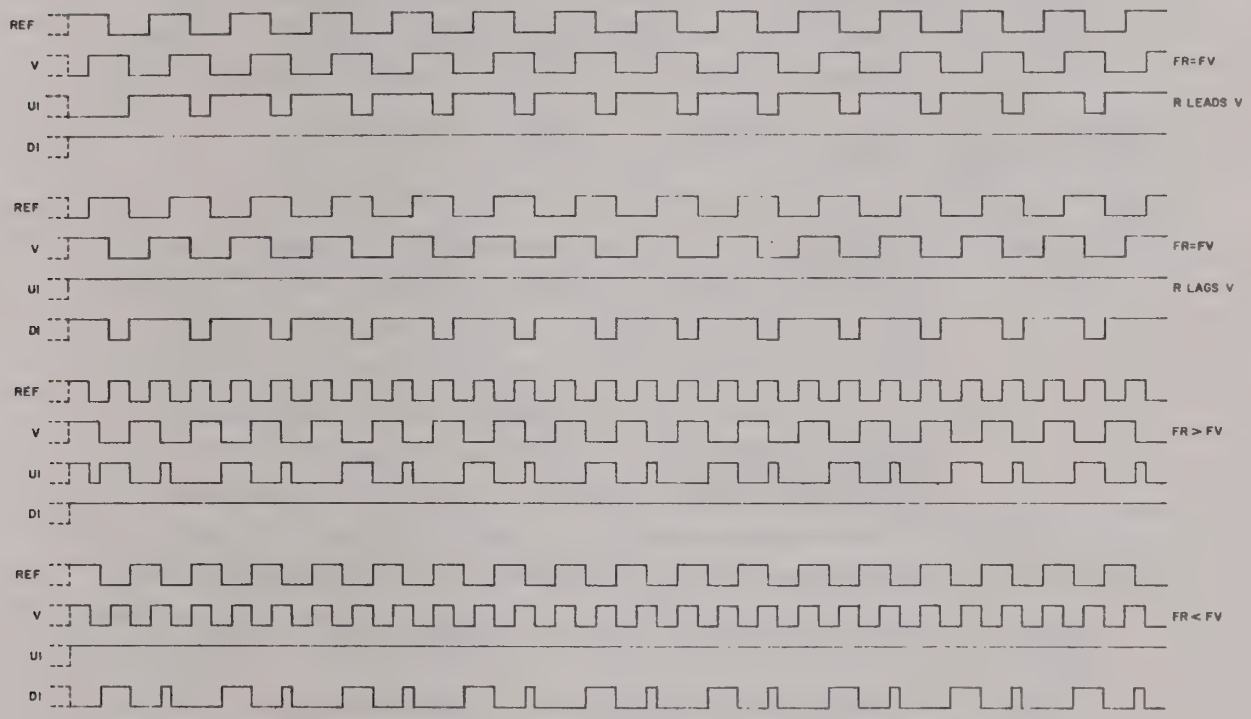


Figure 4-20. Phase Detector Timing Diagram

4.7.4.2 2nd LO Synthesizer Troubleshooting Test

Troubleshooting the 2nd LO is required when the output from module pin B15 does not vary between 32.21 and 32.20 MHz when varying the 3 least significant digits of the front panel display from 000 to 999.

PROCEDURE:

1. Determine which of the phase lock loops is causing the problem. When the problem loop is determined, troubleshoot as described below.

   a. 32 MHz Loop. Proper operation of this loop assures a 32 MHz signal to be found on the transistor case (or collector) of Q1. If not, proceed to Step b below.

b. Programmable Loop. Proper operation of this loop assures a 200 kHz signal at pin 1 of U6 when the receiver is tuned to 15.00999 MHz and a 210 kHz signal at pin 1 of U6 when the receiver is tuned to 15.00000 MHz. Illumination of LED CR1 assures a faulty loop. If a problem is not detected, proceed to Step C below.

c. Output Loop. Troubleshooting this loop is required when no problems exist in the two loops tested above and 32.20 to 32.21 MHz is not seen at module pin B15. If so, proceed to Step 3.

2. 32 MHz Loop

a. U3 and U2. U3 is a divide-by-2 counter. The time for two input waveforms at pin 3 of U3 equals the time for one output waveform at pin 5 of U3. If not, determine that the input levels are correct for TTL (low state less than 0.8 V, high state greater than 2.0 V). If these levels do exist and the output is not correct, replace U3. U2 is a divide-by-16 counter. The time for 16 input waveforms at pin 8 of U2 equals the time for one output waveform at pin 12 of U2. If not, replace U2.

b. Assure proper operation of phase detector U1. Check 1 MHz reference at pin 1 of U1. If wrong or no signal, troubleshoot Time Base Circuits. Compare inputs (pins 1 and 3) and the output voltage at pins 2 and 13 to Figure 4-19 of the 1st LO Troubleshooting Test. A working voltage may vary from 2.0 to 3.5 Vdc (at pin 8 of U1).

c. Vary capacitor C51 (inside shielded unit) until 2.7 Vdc (nominal) is seen at test point E1, when the tuning tool is withdrawn from the shield.

d. If problem appears to be in the VCO, read section 3.3.6 then troubleshoot.

3. Programmable Loop

a. U19, U17 and U16. The time for one waveform at pin 5 of U19 equals 10 waveforms at pin 6 of U19. If not, replace U19. The time for one waveform at pin 12 of U17 equals 10 waveforms at pin 8 of U17. If not, replace U17. The time for one waveform at pin 7 of U16 equals 10 waveforms at pin 15 of U16 (difficult to read with scope since frequency at pin 15 varies from 200 - 210 MHz). If not, replace U16.

b. Operation of -100/-101 prescaler. Tune receiver to 15.00999 MHz. The time for 10 input waveforms at pin 2 of U14 equals one output waveform at pin 11 of U14. If not, replace U14.

c. Operation of counters. Tune the receiver to 15.00000 MHz. This sets all inputs (A, B, C, and D) to U7, U8 and U9 with 0 Vdc. Using a frequency counter with an input impedance of greater than 1000 Ω, the following frequencies in Table 4-9 should be found at the corresponding pins. If not, replace that IC.

Table 4-9. 2nd LO Frequency Chart

IC PIN	FREQUENCY	IC PIN	FREQUENCY
U7 Pin 14	2.09 MHz	U9 Pin 3	1.05 MHz
U7 Pin 13	100 kHz	U9 Pin 13	130 kHz
U8 Pin 4	100 kHz	U10 Pin 14	130 kHz
U8 Pin 13	10 kHz	U10 Pin 12	10 kHz
U9 Pin 14	2.09 MHz	U10 Pin 11	10 kHz

d. Phase Detector U12. Check for 10 kHz signal at pin 1 of U12. If incorrect or no signal, troubleshoot Time Base Circuits. Compare inputs (pins 1 and 3) and outputs 2 and 13 to Figure 4-20 of the 1st LO Troubleshooting Test.

e. Tune receiver to 15.00499 MHz. Spread or compress the turns of coil L8 until 4.0 Vdc is seen at test point E3. Recheck the voltage at test point E3 to be certain that it remains between +2.0 Vdc and 6.5 Vdc as the receiver is tuned from 15.00000 to 15.00999 MHz.

f. If problems appears to be in the VCO, read section 3.3.6 then troubleshoot.

4. Output Loop

   a. Measure the frequency of the output at module pin B15. If no signal is present, there is a problem in the VCO or its output amplifier. Check gate 1 of Q3 (pin 3) for signal. If there is none, the problem is with the VCO circuit of Q6. If the signal is there the problem is in the circuit of amplifier Q3. If the signal is present at pin B15 adjust C61 to bring it as close as practical to 32.200 MHz.

   b. With the VCO very near 32.200 MHz check the signals at pins 1 and 3 of U6. Both should be TTL level signals of approximately 200 kHz (that is low less than 0.8 V and high greater than 2.0 V). If the wrong signal is at pin 1 troubleshoot the programmable loop (step 3); if the wrong signal is at pin 3 proceed below.

   c. Check the base of Q2. The signal there should be roughly sinusoidal and about 0.5 V peak to peak. If so, the problem is in the circuit of Q2. If not, the problem is in the circuits of U4 and U5.

   d. Because of the low signal levels at the inputs of U4 and U5, signal tracing is difficult. The signal at U4 pin 1 should be 32.2 MHz, at U4 pin 7 should be 32.0 MHz and at U5 pins 1 and 2 should be 200 kHz. Grounding of the scope probe is critical if the true signal is to be isolated. It is more likely that careful visual inspection of these circuits and a few voltage checks will be useful. The voltage at pins 1 and 2 of U5 will be approximately +5 V and must be equal within 0.2 Vdc. If they differ by more than this, replace U4. If the 200 kHz at pins 1 and 2 of U5 can be measured the output at pin 6 should be amplified by about 10 times from that level. There may be some distortion present at the output of U5 which is reduced at the base of Q2.

   e. If the signals at pins 1 and 3 of U6 both appear correct, compare its outputs at pins 2 and 13 with those of Figure 4-19. If these appear correct the problem must be in the amplifier section of U6 pins 8 and 9 and its connection to the VCO.

4.7.4.3 3rd LO Synthesizer Troubleshooting Test

Troubleshooting the 3rd LO is required when the output from module pin connection A55 or on-board test point E12 is not 11.155 MHz. When this is determined, follow the troubleshooting steps below.

1. Assure all inputs to the 3rd LO circuitry are correct. If not, troubleshoot Time Base Circuits.

   a. 50 kHz signal at pin 11 of U21.

   b. 10 kHz signal at pin 3 of U21.

2. Operation of U21. The time for two input waveforms at pin 3 of U21 equals one output waveform at pin 5 of U21. If not, replace U21.

3. Assure proper operation of U22. Observe inputs (pins 1 and 3) and output voltage (pins 2 and 13) and compare to Figure 4-20. If a difference exists, replace U22. A normal value for the output (pin 8) is 2.0 to 3.0 Vdc.

4. Proper alignment of C33 assures an approximate 2.75 Vdc at pin 8 of U22.

5. If problems lead to the VCO, read section 3.3.4 in the Circuit Description Section and troubleshoot.

4.7.4.4 BFO Troubleshooting Test

This test divides the BFO circuitry into 3 parts: programmable circuits, phase detector, and amplifiers and output dividers. Each section will be discussed separately. Troubleshooting the BFO is required when 455 kHz is not seen at module pin 55.

1. Set Front Panel BFO Thumbwheel Switches to "+0.0".

2. Programmable Circuits. Use this procedure when a 1 kHz signal is not seen entering the phase detector, pin 3 of U9.

   a. The frequencies in Table 4-10 should be found at the corresponding IC pins. If problem is detected, troubleshoot and/or replace the IC from which the signal originates.

Table 4-10. BFO Frequency Chart

IC	PIN	FREQ(Hz)	IC	PIN	FREQ(Hz)	IC	PIN	FREQ(Hz)
U1	2	910K	U2	2	91K	U3	2	9K
U1	3	2.275	U2	3	228K	U3	3	23K
U1	4	0	U2	4	455K	U3	4	46K
U1	6	455K	U2	6	46K	U3	6	5K
U1	7	455K	U2	7	46K	U3	7	5K
U1	11	1K	U2	11	1K	U3	11	1K
U1	14	4.55 M	U2	14	4.55 M	U3	14	4.55 M

IC	PIN	FREQ (Hz)	IC	PIN	FREQ(Hz)	IC	PIN	FREQ(Hz)
U4	2	1K	U5	2	1K	U6	10	27K
U4	3	3K	U5	4	1K	U6	11	24K
U4	4	5K	U5	5	5K	U6	12	12K
U4	6	1K	U5	6	5K	U6	13	13K
U4	7	1K	U6	1	5K	U7	1	455K
U4	11	1K	U6	2	46K	U7	2	455K
U4	14	4.55 M	U6	3	12K	U7	4	910K
U5	8	27K	U6	4	228K	U7	5	2.275K
U5	9	9K	U6	5	455K	U7	6	455K
U5	10	23K	U6	6	24K	U7	8	4.55K
U5	12	46K	U6	8	1K	U7	9	4.55K
U5	13	91K	U6	9	1K	U8	2	1K

3. Phase Detector U9

   A. 1 kHz signal should be seen at pin 1 of U9. If not, troubleshoot Time Base Circuits.

   B. A voltage level of roughly 1.25 Vdc should be seen at pin 10 of U9. If not, replace U9.

   C. Adjust capacitor C8 until a 2.7 Vdc level is seen at module pin 7.

4. Amplifier Q2 and Sine Wave to TTL Converter Q3 should be troubleshot when the signal from the VCO through capacitor C10 is not amplified at the collector of Q3. Refer to the circuit description for these circuits, section 3.3.5.2.

5. Output Divider U10. Use Table 4-11 below to check the operation of U10 with the BFO thumbwheel settings set to "+0.0".

Table 4-11. Output Divider U10 Frequency Chart

IC	PIN	FREQ (Hz)
U10	1	4.55 M
U10	11	910 K
U10	12	455 K
U10	14	910 K

4.7.4.5 Time Base Circuits Troubleshooting Test

Using the internal frequency source, the frequencies in Table 4-12 should be found at the corresponding IC pins. A digital counter is the recommended method to check the frequencies, however, an oscilloscope may be used remembering the time for one input waveform is proportional to the time for one output waveform by the dividing ratio of the IC.

Table 4-12. Time Base Frequency Chart

IC	PIN	FREQUENCY	IC	PIN	FREQUENCY
U15	5	1 MHz	U18	12	10 kHz
U15	6	1 MHz	U19	5	250 kHz
U15	8	2 MHz	U19	12	50 kHz
U15	12	200 kHz	U20	5	5 kHz
U17	12	40 kHz	U20	12	1 kHz
U18	5	500 kHz	U23	8	1 MHz
U18	8	1 MHz	U23	11	1 MHz

4.7.5 POWER SUPPLY SECTION TROUBLESHOOTING PROCEDURE

The power supply section contains regulators and a +10 V unregulated supply on the main chassis, one regulator on the 1st and 3rd LO Assembly, and two regulators on the synthesizer motherboard. Regulator performance is tested here leaving only wiring and filtering for troubleshooting.

1. Main Chassis

    a. Regulator U1 (+15 Vdc). U1 is labeled on the back panel with its pin connections inside the receiver. Pin 2 is located closest to the top of the receiver and has a rated output of +15 Vdc. Pin 1 is powered by roughly +22 Vdc and the pin where both capacitors meet is ground, 0 Vdc.

b. Regulator U2 (-15 Vdc). U2 is labeled on the back panel with its pin connections inside the receiver. Pin 2 is the closest of the three to the top of the receiver and has a rated output of -15 Vdc. Pin 1 is powered by roughly -22 Vdc and the pin where both capacitors meet is ground 0 Vdc.

c. Regulator U3. Pin 3 is closest to the top of the receiver and has a value of +5 Vdc. The point where the two capacitors from the other pins meet is ground 0 Vdc, and pin 1 has an input of roughly +10 Vdc.

d. Unregulated +10 Vdc. Test point E3 is found on the bottom side of the receiver with an unregulated value between 7.5 Vdc (full load) and 11.0 Vdc (no load).

2. Synthesizer Motherboard

a. Regulator A5U1 (+5 Vdc). This regulator is found on the bottom side of the receiver connected to the motherboard. A voltage of approxmately 8.5 Vdc from the unregulated +10 Vdc enters the regulator at pin 1 and +5.0 Vdc leaves at pin 2. Pin 3 is a ground connection.

b. Regulator A5U2 (+5 Vdc). This regulator is found on the bottom side of the receiver connected to the motherboard. A voltage of approximately 8.5 Vdc enters the regulator at pin 1 and +5.0 Vdc leaves at pin 2. Pin 3 is a ground connection.

3. 1st and 3rd LO Assembly

a. This regulator is found directly on the 1st and 3rd LO Type 791630, to the right of the VCO. A voltage of -15 Vdc enters pin 3 of VR1 and a regulated -12 Vdc leaves from pin 2. Pin 1 is a ground connection.

4.8 ALIGNMENT AND ADJUSTMENT PROCEDURES

4.8.1 GENERAL

The following alignment and adjustment procedures should not be performed on a routine basis, but instead be used as aids in troubleshooting and post-repair check-out. Before alignment is attempted, the technician should first perform relevant tests to determine which sections of the receiver need alignment. These procedures may be used for testing or aligning new and repaired subassemblies.

4.8.2 SYNTHESIZER ALIGNMENT

4.8.2.1 1st LO Synthesizer Alignment (A5A1A2)

The only alignment points for the 1st LO Synthesizer are in the 1st LO VCO which is a very sensitive circuit; care must be taken to ensure proper operation. This procedure should be performed only when a definite alignment is needed. Table 4-13 lists the components and their parameters used in this alignment procedure.

1. Mount the 1st and 3rd LO on its extender card.
2. Remove the VCO's front plate.
3. Connect a digital voltmeter to module pin B1.
4. Align the VCO from band 0 to band 7. As suggested in Table 4-13, components L2, L3 and L4 align the VCO in more than one band.
5. Align each VCO band monitoring the voltage at module pin B1. Then check the 1st LO frequency band (TP E3 in the VCO) while dialing the tuned frequency in 10 kHz steps starting with 00.00000 MHz.

Table 4-13. VCO Alignment Parameters

VCO BAND	1st LO FREQ BAND (MHz)	VOLTAGE Pin B1 (Typical)	ALIGNMENT COMPONENT
0	42.91-46.90	-8.5 to 6.0	C6*, L1
1	46.91-50.90	-7.5 to 4.1	L2
2	50.91-54.90	-7.2 to 2.8	L3
3	54.91-58.90	-5.3 to 3.9	L2, L3
4	58.91-62.90	-6.6 to 2.7	L4
5	62.91-66.90	-6.0 to 2.2	L4, L2
6	66.91-70.90	-6.2 to 0.4	L3, L4
7	70.91-72.90	-5.7 to -3.0	L4, L3, L2

*Factory Select Value

4.8.2.2 2nd LO Synthesizer Alignment (A5A2)

1. Assure correct power supply inputs to the 2nd LO as shown in Table 4-14.

2. 32 MHz Loop Alignment

   a. Mount 2nd LO circuit board on its extender card and connect a digital voltmeter to test point E1.

   b. Insert alignment tool into opening in VCO shield and adjust capacitor C51 so a reading of 2.7 to 3.0 Vdc is seen with the alignment tool withdrawn from the VCO shield.

3. Output Loop Alignment

   a. Connect a digital voltmeter to test point E2.

   b. Insert alignment tool into opening of VCO shield and adjust capacitor C61 so a reading of 2.7 to 3.0 Vdc is seen on the voltmeter when the alignment tool is withdrawn from the VCO can.

4. Programmable Loop Alignment

   a. Set tuned frequency to 00.00499 MHz. Connect a digital voltmeter to E3.

   b. Insert alignment tool into opening in VCO shield and spread or squeeze the turns of inductor L8 until a reading of 4.0 Vdc is seen on the voltmeter with the alignment tool withdrawn. Tune the receiver from 00.00999 MHz to be certain the voltage at E3 remains between 2.0 and 6.5 Vdc.

Table 4-14. 2nd LO Voltage Parameters

IC	PIN	VOLTAGE	RESISTOR	VOLTAGE
U1	14	5 Vdc	R1	15 Vdc
U6	14	5 Vdc	R2	15 Vdc
U8	16	5 Vdc	R3	15 Vdc

4.8.2.3 3rd LO Synthesizer Alignment (A5A1 A2)

1. Mount the 1st and 3rd LO on its extender card and connect a digital voltmeter to the pin 8 of U22.
2. Adjust capacitor C33 until a reading of 3.0 Vdc is seen on the voltmeter.

4.8.2.4 BFO Synthesizer Alignment (A5A3)

Two alignments are required for the BFO. Capacitor C8 and Resistor R1 are interdependent and must be aligned simultaneously.

1. Mount the BFO circuit board on its extender card.
2. Adjust C8 until the closest reading to 3.0 Vdc is seen at module pin 7.
3. Adjust R1 until the voltage difference between gate to source of Q4 (pins 3 and 2) is 0 Vdc (the voltage from gate to ground and from source to ground will be approximately 1.2 Vdc).
4. Adjust C8 again until the closer reading to 3.0 Vdc is seen at module pin 7.

4.8.3 RECEIVER ALIGNMENT

4.8.3.1 Input Converter Alignment (A3)

1. Disconnect input converter from chassis and connect to the test equipment as shown in Figure 4-21.
2. Set front panel controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	AM
e. RF Gain	Maximum clockwise
f. Phone Level	Midway
g. IF Bandwidth	16 kHz
h. BFO Offset	00.0 (kHz)

3. Set signal generator to -99 dBm, unmodulated at 15.00500 MHz. Tune receiver to 15.00500 MHz.

4. While observing RF Voltmeter, adjust C3 of A3A1 and C11 of A3C2 for a maximum meter reading (30 mV, nominal).

4.8.3.2 10.7 MHz Filter Switch Adjustment (A4A1)

1. Disconnect P28, 10.7 MHz input to IF strip (at jack A2J2 of Input Converter). Feed 10.7 MHz unmodulated signal @ -50 dBm level, into P28 or TP1 input of IF motherboard as shown in Figure 4-22.

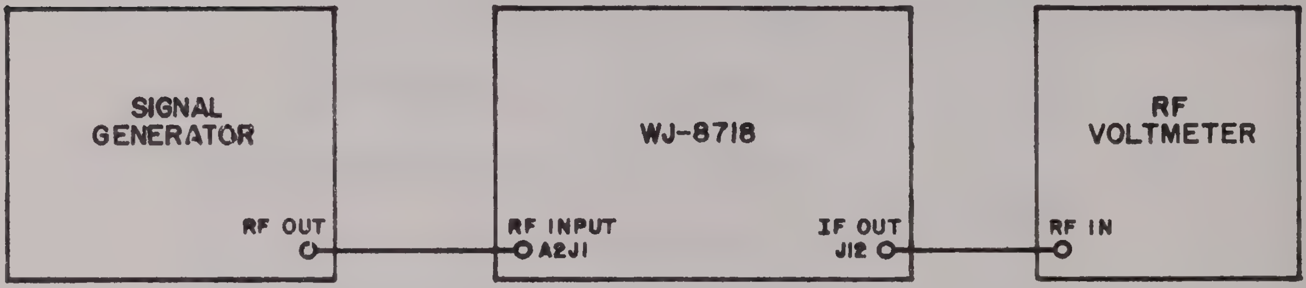

SIGNAL GENERATOR
RF OUT
WJ-8718
RF INPUT
A2J1
IF OUT
J12
RF VOLTMETER
RF IN

Figure 4-21. Test Setup, Input Converter

2. Remove card A4A2 and set A4A1 on extender card.
3. Connect input of RF Voltmeter, terminated in 50 Ω to TP2.
4. Depress the 3.2 kHz Bandwidth button and adjust R7 for a -36 dBm reading.
5. Depress the 6 kHz Bandwidth button and adjust R22 for a -36 dBm reading.
6. Depress the 16 kHz Bandwidth button and adjust R39 for a -36 dBm reading.

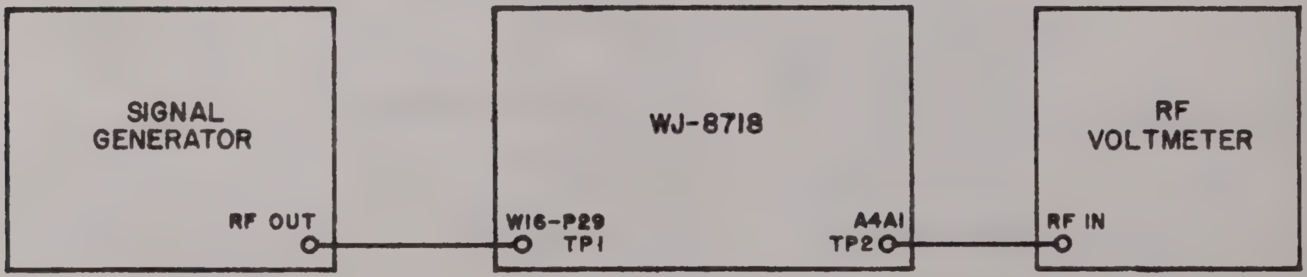

SIGNAL GENERATOR
RF OUT
WJ-8718
W16-P29
TP1
A4A1
TP2
RF VOLTMETER
RF IN

Figure 4-22. Test Setup, 10.7 MHz Filter Switch

4.8.3.3 USB Filter Switch Adjustment (A4A4)

1. Set front panel controls as follows:

a.	Power	ON
c.	Meter	Signal Strength
d.	Gain Mode	Manual
e.	Detection Mode	AM
f.	RF Gain	Maximum Clockwise
g.	Phone Level	Midway
h.	IF Bandwidth	16 kHz
i.	BFO Offset	00.00 (kHz)

2. Tune receiver to 15.00500 MHz and inject a 15.00500 MHz unmodulated signal to antenna input A2J1 on back panel.

3. Adjust output level of generator until signal strength meter reads the SET level.

4. Now tune signal generator to 15.00540 MHz and switch detection mode to USB.

5. Adjust potentiometer R11 until meter reads the SET level or until R11 is at a maximum setting, whichever comes first.

6. Compare output level of this card to ISB/LSB Filter Switch (A4A5) and equalize.

NOTE: The objective of this adjustment is to equalize the output levels of both the USB Filter Switch (A4A4) and the ISB/LSB Filter Switch (A4A5). Therefore, perform adjustment procedure for A4A5 until both output levels are closest to the SET level and equal.

4.8.3.4 ISB/LSB Filter Switch Adjustment (A4A5)

1. Set front panel controls as follows:

a.	Power	ON
b.	Meter	Signal Strength
c.	Gain Mode	Manual
d.	Detection Mode	AM
e.	RF Gain	Maximum Clockwise
f.	Phone Level	Midway
g.	IF Bandwidth	16 kHz
h.	BFO Offset	00.0 (kHz)

2. Tune receiver to 15.00500 MHz and inject a 15.00500 MHz unmodulated signal to antenna input A2J1 on back panel.

3. Adjust output level of generator until signal strength meter reads the SET level.

4. Now tune signal generator to 15.00460 MHz and switch detection mode to LSB.

5. Adjust potentiometer R11 until meter reads the SET level or until R11 is at a maximum setting, whichever comes first.

6. Compare output level of this card to USB Filter Switch (A4A4) and equalize.

NOTE: The objective of this adjustment is to equalize the output levels of both the USB Filter Switch (A4A4) and the ISB/LSB Filter Switch (A4A5). Therefore, perform adjustment procedure for A4A4 until both output levels are closest to the SET level and equal.

4.8.3.5 455 kHz Amplifier/AM Detector Alignment (A4A7)

1. Place the receiver in the MAN gain mode and in the 16 kHz bandwidth position. Rotate the RF GAIN control fully clockwise.

2. Remove cards A4A3 and A4A10 and connect the equipment as shown in Figure 4-23.

3. Set the sweep generator for a -10 dBm 455 kHz unmodulated RF output.

4. Set the marker signal generator to within +0.1 kHz of 455 kHz.

5. Adjust the generator and oscilloscope controls for an undistorted response.

6. Adjust L2 and L3 for a maximum amplitude symmetrical response about the marker similar to the response shown in Figure 4-24.

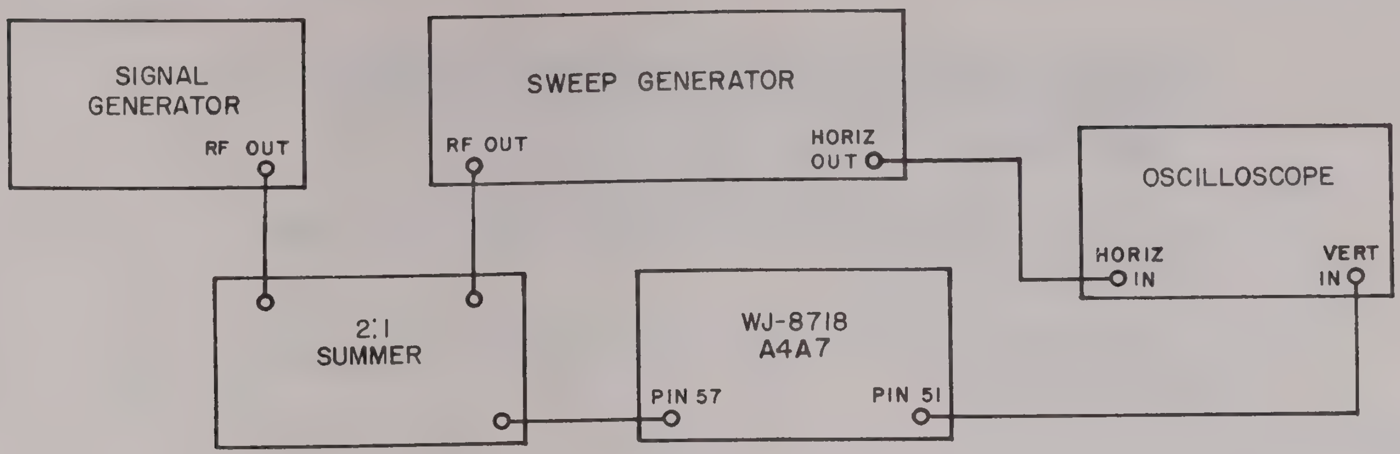

SIGNAL GENERATOR
RF OUT
SWEEP GENERATOR
RF OUT
HORIZ OUT
OSCILLOSCOPE
HORIZ IN
VERT IN
2:1 SUMMER
WJ-8718 A4A7
PIN 57
PIN 51

Figure 4-23. Test Setup. 455 kHz Amplifier Alignment

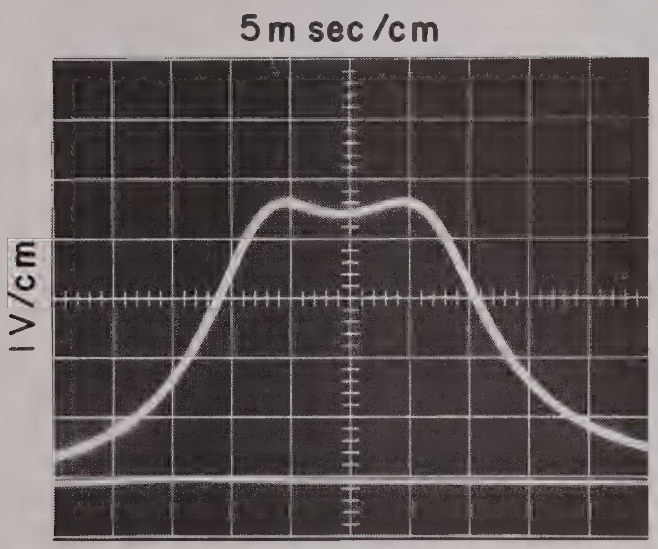


Figure 4-24. Typical Response, 455 kHz Amplifier Alignment

4.8.3.6 455 kHz Amplifier/AM Detector Adjustment (A4A7)

1. Connect equipment as shown in Figure 4-25.

2. Set front panel controls as follows:

a. Power	ON
b. Meter	Signal Strength
c. Gain Mode	Manual
d. Detection Mode	AM
e. RF Gain	Maximum Clockwise
f. Phone Level	Midway
g. IF Bandwidth	6 kHz
h. BFO Offset	00.0 (kHz)

3. Set signal generator to 15.00500 MHz unmodulated at 3μV (approximately -97 dBm). Also tune the receiver to 15.00500 MHz.

4. Set RF Voltmeter to the 100 mV scale. Make sure meter is terminated in 50 Ω.

5. Set R7 of A4A7 for a reading on the voltmeter of approximately 40 mV.

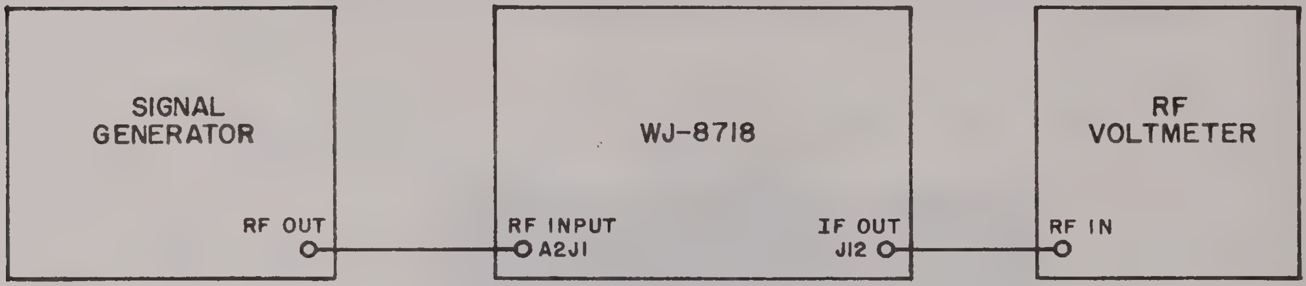


Figure 4-25. Test Setup, 455 kHz Amplifier/AM Detector

4.8.3.7 ISB Detector/Audio Adjustment (A4A8)

1. Connect the equipment as shown in Figure 4-26.

2. Set receiver controls as follows:

Detection Mode	ISB
Gain Mode	Manual
RF Gain	Maximum Clockwise
Meter	N/A
IF Bandwidth	N/A

3. Set the signal generator to a -105 dBm unmodulated signal at 15.00460 MHz. Also tune receiver to 15.00500 MHz.

4. With equipment connected properly, an audio output of approximately 400 Hz should be seen on the scope.

5. Switch detection mode to LSB and adjust phone level gain to a convenient level below clipping. Note this level.

6. Switch detection mode back to ISB and wait a moment to allow for any settling of SLOW AGC. Adjust R8 of A4A8 to obtain the same output as viewed in LSB mode, or until output is at its maximum.

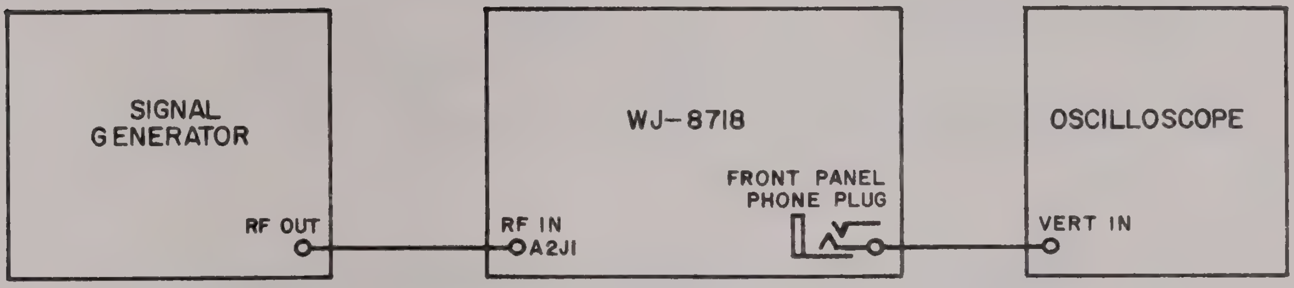

SIGNAL GENERATOR
RF OUT
WJ-8718
RF IN
A2J1
FRONT PANEL PHONE PLUG
OSCILLOSCOPE
VERT IN

Figure 4-26. Test Setup, ISB Detector/Audio

4.8.3.8 FM Discriminator Alignment (A4A9)

1. Make sure the receiver is off, remove cards A4A7 and A4A10.

2. Connect the equipment as shown in Figure 4-26 and reapply power.

3. Place the receiver in the FM detection mode.

4. Set the marker signal generator for a 455 kHz, -10 dBm level output. Set the sweep generator for a 455 kHz RF output.

5. Adjust the generator and oscilloscope controls for an undistorted response.

6. Adjust L1 and T1 for a symmetrical response about the marker as shown in Figure 4-28.

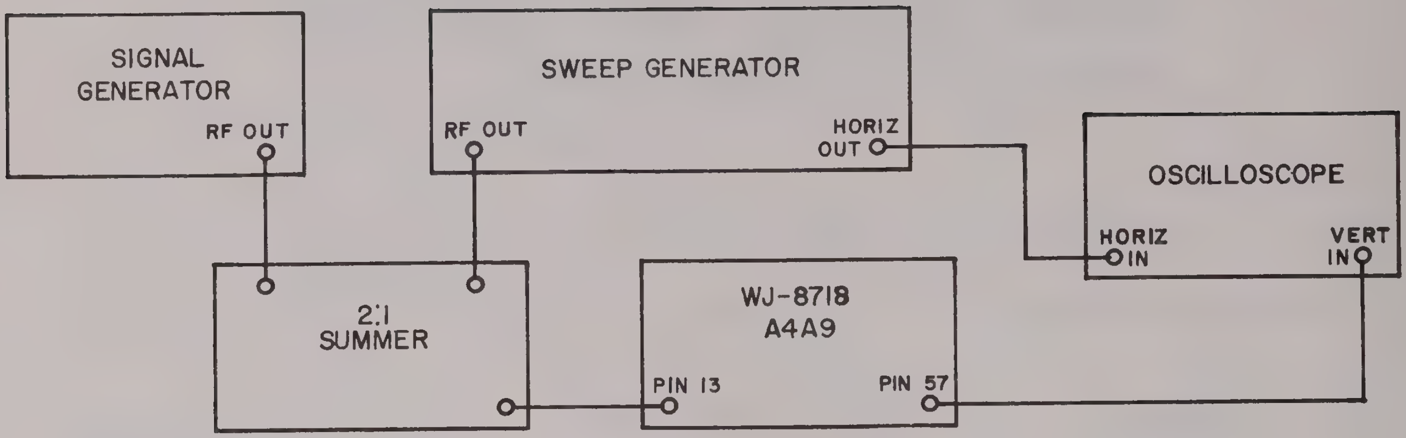

SIGNAL GENERATOR
RF OUT
SWEEP GENERATOR
RF OUT
HORIZ OUT
OSCILLOSCOPE
HORIZ IN
VERT IN
2:1 SUMMER
WJ-8718 A4A9
PIN 13
PIN 57

Figure 4-27. Test Setup, FM Discriminator Alignment

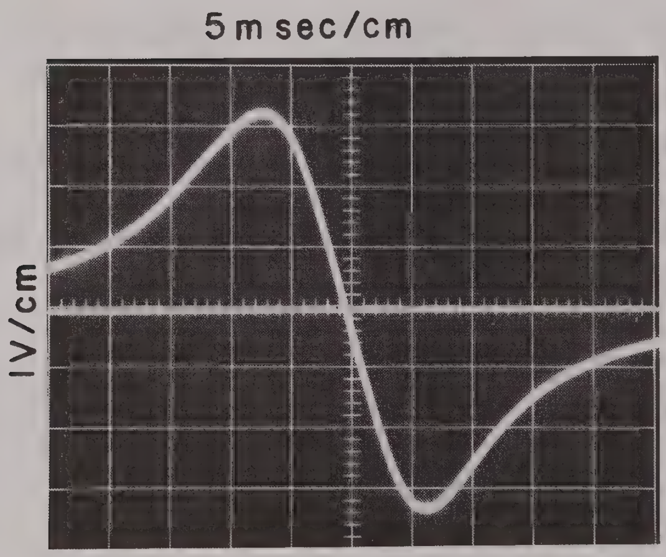


Figure 4-28. Typical Response, FM Discriminator

4.8.4 2ND LO FILTER ADJUSTMENT

1. Disconnect 2nd LO (A2J1) from Input Converter and connect to 50 Ω terminated end of RF Voltmeter.

2. Set meter to 0 dBm scale and energize receiver.

3. Adjust C13 which is beneath the synthesizer section towards the front of the receiver, for maximum reading on voltmeter.

4.8.5 LED INTENSITY ADJUSTMENT

The intensity of the front panel frequency display may be varied by potentiometer R2. R2 is located inside the front panel on the left side of the LED's. Rotating R2 clockwise increases the LED intensity.

SECTION V
REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules) and parts. An example of the unit method follows:

Subassembly Designation A1 R1 Class and No. of Item

Identify from right to left as: First (1) resistor (R) of
first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consists of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Reference Designation Prefixes are provided on drawings and illustrations in parenthesis within the figure titles.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	AMP, Incorporated P.O. Box 3608 Harrisburg, PA 17105
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, WI 53204
01295	Texas Instruments, Inc. Semiconductor-Components Div. 13500 North Central Expressway Dallas, TX 75231
02114	Ferroxcube Corporation P.O. Box 359 Mt. Marion Road Saugerties, NY 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, NJ 08876
04713	Motorola Incorporated Semiconductor Products Div. 5005 East McDowell Road Phoenix, AZ 85008

Mfr. Code	Name and Address
06978	Aladdin Electronics Div. of Aladdin Industries, Inc. 703 Murfreesboro Road Nashville, TN 37210
07263	Fairchild Camera & Instr. Corp. Semiconductor Division 464 Ellis Street Mountain View, CA 94040
07388	Torotel Incorporated 13402 South 71 Highway Grandview, MO 64030
09353	C & K Components, Inc. 103 Morse Street Watertown, MA 02172
12498	Teledyne Crystalonics 147 Sherman Street Cambridge, MA 02140
13103	Thermalloy Company 2021 W. Valley View Lane Dallas, TX 75234
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20760
14655	Cornell-Dubilier Electronics Div. of Federal Pacific Electric Co. 150 Avenue L Newark, NJ 07101
15818	Teledyne Semiconductor 1300 Terra Bella Avenue Mountain View, CA 94040
16428	Belden Corporation P. O. Box 1101 Richmond, IN 47374
17856	Siliconix, Inc. 2201 Laurelwood Road Santa Clara, CA 95050
18324	Signetics Corporation 811 East Arques Avenue Sunnyvale, CA 94086
19209	General Electric Company Battery Business Department P.O. Box 114 Gainsville, FL 32602
19505	Applied Engin. Products, Co. Division of Samarious, Inc. 300 Seymour Avenue Derby, CT 06418
21604	The Buckeye Stamping Co. 555 Marion Road Columbus, OH 43207
25088	Siemens America, Inc. 186 Wood Avenue S. Iselin, NJ 08830
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27956	Relcom 3333 Hillview Avenue Palo Alto, CA 94304

Mfr. Code	Name and Address
28480	Hewlett-Packard Company Corporate Headquarters 1501 Page Mill Road Palo Alto, CA 94304
31918	IEE/Schadow Incorporated 8081 Wallace Road Eden Prairie, MN 55343
33095	Spectrum Control, Inc. 152 E. Main Street Fairview, PA 16415
52748	Alpha Components, Inc. 5223 East Simpson Ferry Road Mechanicsburg, PA 17055
56289	Sprague Electric Company Marshall Street North Adams, MA 01247
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
71400	Bussman Manufacturing Division of McGraw-Edison Co. 2536 W. University Street St. Louis, MO 63107
71590	Centralab Electronics Division of Globe-Union, Inc. 5757 North Green Bay Avenue Milwaukee, WI 53201
71785	TRW Electronic Components Cinch Connector Operations 1501 Morse Avenue Elk Grove Village, IL 60007
72136	Electro Motive Mfg. Co., Inc. South Park & John Streets Willimantic, CT 06226
72982	Erie Technological Products, Incorporated 644 West 12th Street Erie, PA 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, CA 92634
74306	Piezo Crystal Company 100 K Street Carlisle, PA 17013
74868	Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, CT 06810
75042	TRW Electronic Components IRC Fixed Resistors 401 North Broad Street Philadelphia, PA 19108
75915	Littelfuse, Incorporated 800 E. Northwest Highway Des Plaines, IL 60016

Mfg. Code	Name and Address	Mfg. Code	Name and Address
80058	Joint Electronic Type Designation System	88245	Litton Industries USECO Division 13536 Saticoy Street Van Nuys, CA 91409
80103	Lambda Electronics Corp. Div. of Veeco Instruments, Inc. 515 Broad Hollow Road Melville, NY 11746	91293	Johanson Manufacturing Co. P.O. Box 329 Boonton, NJ 07005
80131	Electronic Industries Association 2001 Eye Street, N.W. Washington, D.C. 20006	91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, IL 60646
81312	Winchester Electronics Division Litton Indistries, Incorporated Main Street & Hillside Avenue Oakville, CT 06779	91984	Maida Development Company 214 Academy Street Hampton VA 23369
81349	Military Specifications	92825	Whitso Incorporated 9330 Bryon Street Schiller Park, IL 60176
81350	Joint Army-Navy Specifications	93332	Sylvania Elec. Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, MA 01801
82389	Switchcracft, Incorporated 5555 North Elston Avenue Chicago, IL 60630	93958	Republic Electronics Corp. 176 East 7th Street Paterson, NJ 07524
84411	TRW Electric Components TRW Capacitors 112 W. First Street Ogallala, NE 69153	95121	Quality Components, Inc., P.O. Box 113 St. Mary's, PA 15857
87014	Magnuson Products Corporation 50 Court Street Brooklyn, NY 11201	98291	Sealectro Corporation 225 Hoyt Mamaroneck, NY 10544

Mfr.
Code

98978 International Electronic Research Corporation
135 West Magnolia Blvd.
Burbank, CA 91502

99800 American Precision Industries
Delevan Electronics Division
270 Quaker Road
East Aurora, NY 14052

99848 Wilco Corporation
4030 West 10th Street
P.O. Box 22248
Indianapolis, IN 46222

5.4 PARTS LIST

The parts list which follows contains all electrical parts used in the equipment and certain mechanical parts which are subject to unusual wear or damage. When ordering replacement parts from Watkins-Johnson Company, specify the type and serial number of the equipment and the reference designation and description of each part ordered. The list of manufacturers provided in paragraph 5.3 and the manufacturer's part number for components are included as a guide to the user of the equipment in the field. These parts may not necessarily agree with the parts installed in the equipment; however, the parts specified in this list will provide satisfactory operation of the equipment. Replacement parts may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original indicated part. In the case of components defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

NOTE

As improved semi-conductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts list and schematic diagrams of this manual. However, the semi-conductors designated in the manual may be substituted in every case with satisfactory results.

5.5 TYPE WJ-8718 HF RECEIVER, MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	Power Distribution	1	76240	14632	
A2	RF Filter	1	791616	14632	
A3	Input Converter	1	791592	14632	
A4	IF Motherboard		791569	14632	
A5	Synthesizer Motherboard	1	791570	14632	
A6	I/O Motherboard	1	791580	14632	
A7	Manual Tuning Module	1	791874-1	14632	
A8	Frequency Display	1	791578	14632	
A9	BFO Switch	1	791827	14632	
A10	Front Panel Control	1	791684	14632	
C1	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	4	34475-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Same as C1				
C5	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	2	34452-1	14632	
C6	Same as C5				
C7	Capacitor, Fixed, Paper: 0.01 μF, 20%, 600 V	6	102P515	56289	
C8 Thru C12	Same as C7				
CR1	Diode	2	1N1614	80131	02735
CR2	Same as CR1				
E1	Terminal	3	7A1A1	92825	
E2	Same as E1				
E3	Same as E1				
E4	Terminal, Standoff, Ground	1	160-2381-01-05-00	71279	
F1	Fuse, Cartridge: 1 AMP, 3 AG, Slow -Blow	1	MDL1	71400	
F2	Fuse, Cartridge: 1/2 AMP, 3AG, Slow -Blow	1	MDL1/2	71400	
FL1	Power Filter	1	34505-1	14632	
J1	Connector, Plug: SMC Series	8	UG1468/U	80058	19505
J2	Connector, Receptacle: HDP-20	1	205203-1	00779	
J3	Same as J1				
J4	Same as J1				
J5	Same as J1				
J6	Connector, Receptacle	1	UG1619	80058	74868

5.5.1 TYPE 76240 POWER DISTRIBUTION REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Electrolytic, Aluminum: 2200 μF, -10+75%, 25 V	2	39D228G025HP4	56289	
C2	Same as C1				
C3	Capacitor, Electrolytic, Aluminum: 8000 μF, -10+75%, 15 V	2	39D808G015JT4	56289	
C4	Same as C3				
CR1	Diode	4	1N4998	80131	04713
CR2 Thru CR4	Same as CR1				
J1	Faston Tab	35	62073-1	00779	
J2 Thru J5	Same as E1				

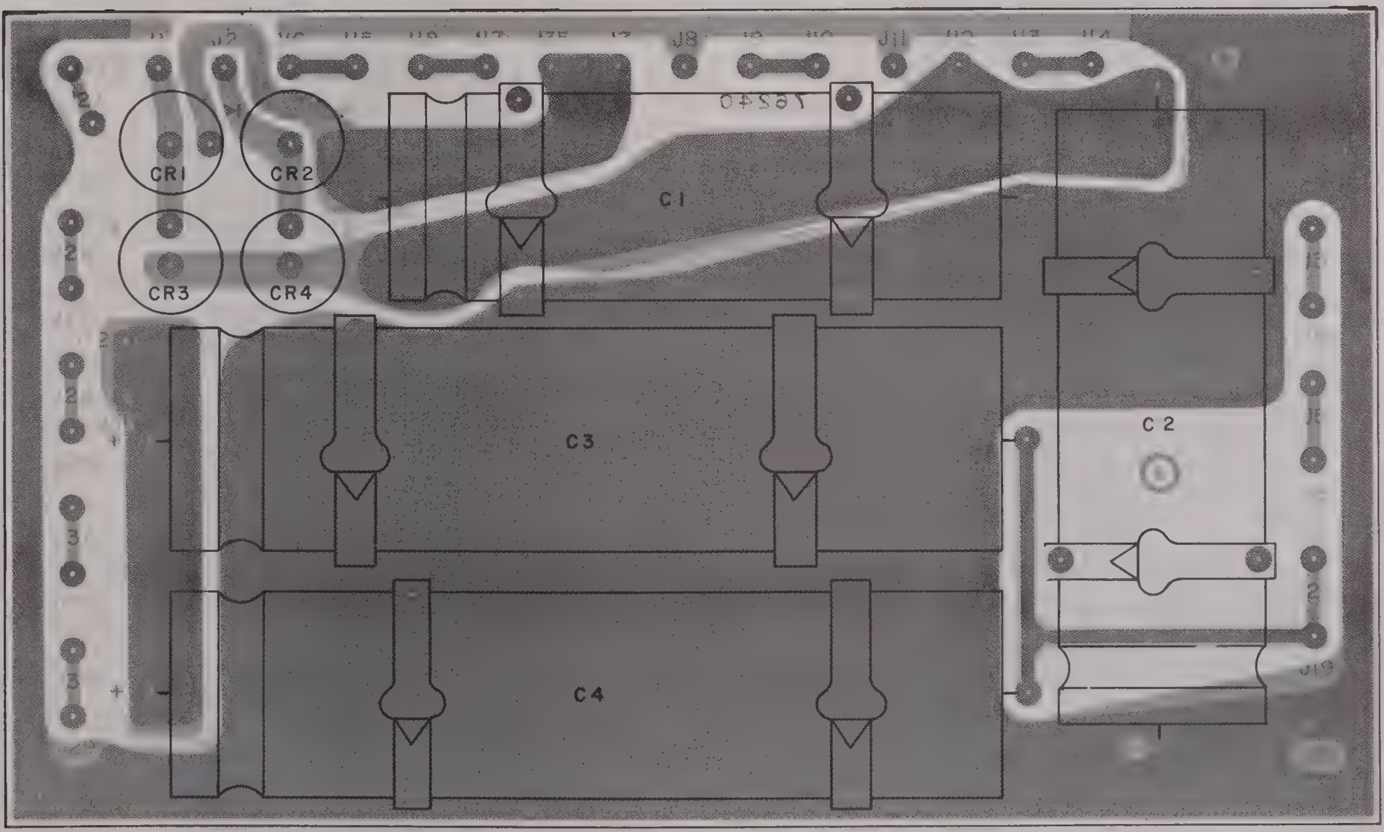


Figure 5-5. Type 76240 Power Distribution (A1), Location of Components

5.5.2 TYPE 791616 RF FILTER

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 100 V	2	8131M100-651-474M	72982	
C2	Same as C1				
C3	Capacitor, Mica, Dipped: 20 pF, 5%, 500 V	1	CM05ED200J03	81349	72136
C4	Capacitor, Mica, Dipped: 68 pF, 2%, 500 V	1	CM05ED680G03	81349	72136
C5	Capacitor, Mica, Dipped: 10 pF±0.5 pF, 500 V	2	CM05CD100D03	81349	72136
C6	Capacitor, Mica, Dipped: 180 pF, 2%, 500 V	3	CM05FD181G03	81349	72136
C7	Same as C5				
C8	Same as C6				
C9	Capacitor, Mica, Dipped: 27 pF, 2%, 500 V	1	CM05ED270G03	81349	72136
C10	Same as C6				
C11	Capacitor, Mica, Dipped: 15 pF, 5%, 500 V	2	CM05CD150J03	81349	72136
C12	Capacitor, Mica, Dipped: 200 pF, 2%, 500 V	2	CM05FD201G03	81349	72136
C13	Capacitor, Mica, Dipped: 220 pF, 2%, 500 V	1	CM05FD221G03	81349	72136
C14	Same as C11				
C15	Same as C12				
C16	Capacitor, Mica, Dipped: 120 pF, 2%, 500 V	1	CM05FD121G03	81349	72136
C17	Capacitor, Mica, Dipped: 47 pF, 2%, 500 V	1	CM05ED470G03	81349	72136
CR1	Diode	2	1N4449	80131	93332
CR2	Same as CR1				
J1	Connector, Receptacle: BNC Series	1	UG1094/U	80058	74868
L1	Coil, Toroidal	2	20681-186	14632	
L2	Coil, Toroidal	1	20681-187	14632	
L3	Same as L1				
L4	Coil, Toroidal	2	20681-188	14632	
L5	Coil, Toroidal	2	20681-189	14632	
L6	Same as L5				
L7	Same as L4				
L8	Inductor: 0.85 μH	1	21209-37	14632	
P1	Connector, Plug: SMC Series	1	UG1466/U	80058	19505
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	1	RCR07G103JS	81349	01121
VR1	Diode, Zener: 6.2 V	2	1N753A	80131	04713
VR2	Same as VR1				

5.5.3 TYPE 791592 INPUT CONVERTER REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	1st Mixer, Ist IF	1	34748	14632	
A2	2nd Mixer, 2nd IF	1	34749	14632	
C1	Capacitor, Ceramic, Feedthru: 1000 pF, GMV, 500 V	4	54-794-009-102W	33095	
C2 Thru C4	Same as C1				
L1	Coil, Fixed: 2.2 μH	1	209-11	99848	
P1	Connector, Plug: HDP-20	1	205204-1	00779	

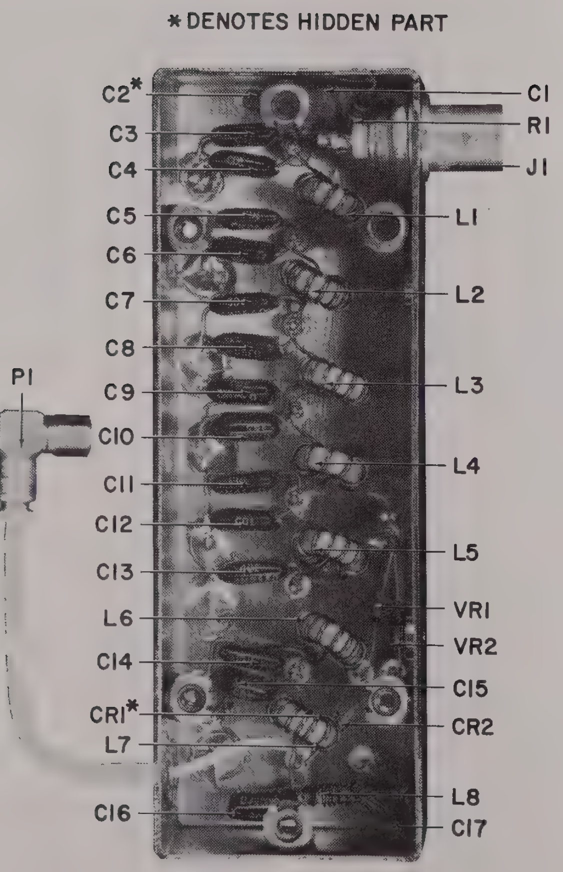

*DENOTES HIDDEN PART
C2*
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
L6
C14
CR1*
L7
C16
P1
C1
R1
J1
L1
L2
L3
L4
L5
VR1
VR2
C15
CR2
L8
C17

Figure 5-6. Type 791616 RF Filter (A2), Location of Components

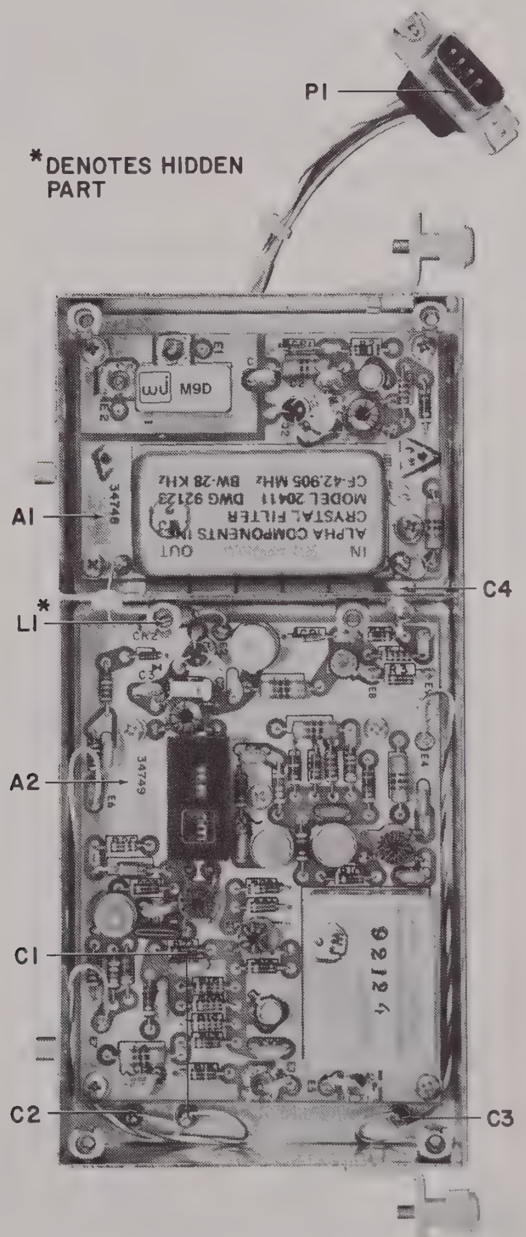

P1
*DENOTES HIDDEN PART
A1
L1*
A2
C1
C2
C4
C3
M9D
34748
34749

Figure 5-7. Type 791592 Input Converter (A3), Location of Components

5.5.3.1 Part 34748 1st Mixer, 1st IF REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 1000 pF, GMV, 500 V	2	SM1000PFP	91418	
C2	Same as C1				
C3	Capacitor, Variable, Ceramic: 2.5-9 pF, 25 V, NPO	1	518-000A2.5-9	72982	
CR1	Diode	1	1N4446	80131	93332
E1	Terminal, Forked	4	140-1941-02-01	71279	
E2 Thru E4	Same as E1				
FL1	Filter	1	92123	14632	
J1	Connector, Receptacle: SMC Series	2	34520-1	14632	
J2	Same as J1				
L1	Coil, Fixed: 10 μH	2	1537-36	99800	
L2	Same as L1				
Q1	Transistor	1	2N2222A	80131	04713
Q2	Transistor	1	CP643	12498	
R1	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	1	RCR07G222JS	81349	01121
R2	Resistor, Fixed, Composition: 82 Ω, 5%, 1/4 W	1	RCR07G820JS	81349	01121
R3	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	1	RCR07G100JS	81349	01121
R4	Resistor, Fixed, Composition: 68 Ω, 5%, 1/8 W	1	RCR05G680JS	81349	01121
RA1	Heatsink	1	1118C	13103	
T1	Transformer Assembly	1	22295-52	14632	
U1	Mixer, Balanced	1	M9D	27956	

5.5.3.2 Part 34749 2nd Mixer, 2nd IF REF DESIG PREFIX A3A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Variable, Ceramic: 2.5-11 pF, 350 V	1	538-011B2.5-11	72982	
C2	Capacitor, Ceramic, Disc: 1000 pF, GMV, 500 V	2	SM1000 PFP	91418	
C3	Same as C2				
C4	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	5	34453-1	14632	
C5 Thru C8	Same as C4				
C9	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	1	34475-1	14632	
C10	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	5	B470PFM	91418	
C11 Thru C13	Same as C10				
C14	Capacitor, Mica, Dipped: 47 pF, 2%, 500 V	1	CM05ED470G03	81349	72136
C15	Same as C10				
C16	Capacitor, Ceramic, Tubular: 4.7 pF±0.1 pF, 500 V	1	301-000C0H0-479B	72982	
CR1	Diode	1	1N4446	80131	93332
CR2	Diode	1	5082-3039	28480	
E1	Terminal, Forked	9	140-1941-02-01	71279	
E2 Thru E9	Same as E1				
FB1	Ferrite Bead	3	56-590-65-4A	02114	
FB2	Same as FB1				
FB3	Same as FB1				
FL1	Filter Bandpass: 10.7 MHz CF, 16 kHz BW	1	92124	14632	
J1	Connector, Receptacle: SMC Series	2	34520-1	14632	
J2	Same as J1				
L1	Coil, Fixed: 10 μH	4	1537-36	99800	
L2	Same as L1				
L3	Same as L1				
L4	Coil, Fixed: 0.56 μH	1	202-11	99848	
L5	Same as L1				
Q1	Transistor	1	2N2222A	80131	04713
Q2	Transistor	1	CP643	12498	
Q3	Transistor	3	2N5109	80131	02735
Q4	Same as Q3				
Q5	Transistor	1	2N2857	80131	02735
Q6	Same as Q3				

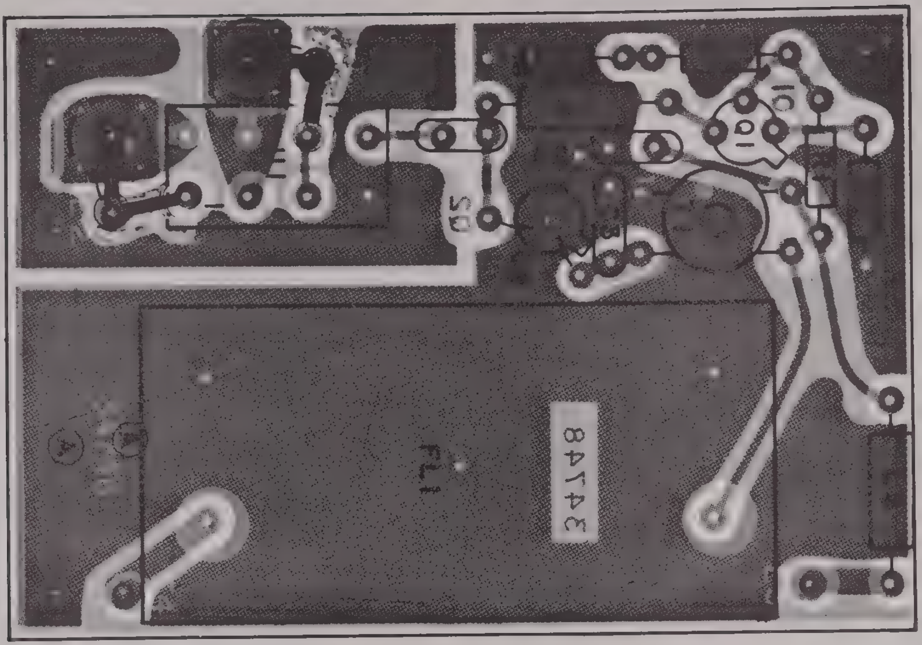


Figure 5-8. Part 34748 1st Mixer/1st IF (A3A1), Location of Components

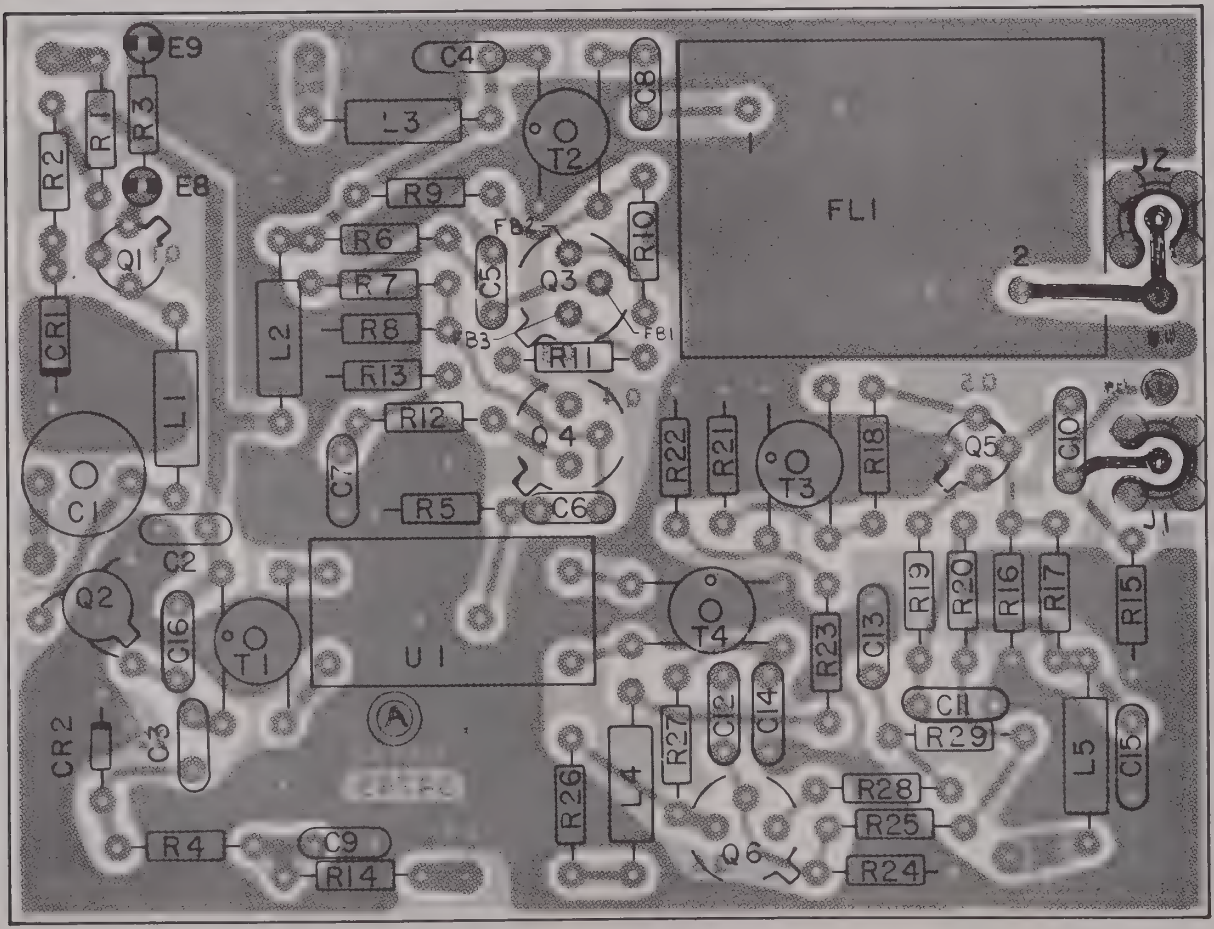

E9
C4
C8
R1
R3
L3
R2
T2
E8
R9
FL1
1
J2
R6
FB2
R10
Q1
R7
C5
Q3
2
CR1
R8
FB3
FB1
R11
L2
R13
L1
R12
Q4
R22
R21
T3
R18
Q5
C10
C1
C7
R5
C6
J1
C2
R19
R20
R16
R17
R15
Q2
C16
T1
U1
T4
R23
C13
C11
C3
A
R27
C12
C14
R29
CR2
L5
C15
R26
L4
R28
R25
R4
C9
Q6
R14
R24

Figure 5-9. Part 34749 2nd Mixer/2nd IF (A3A2), Location of Components

REF DESIG PREFIX A3A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	2	RCR07G222JS	81349	01121
R2	Resistor, Fixed, Composition: 82 Ω, 5%, 1/4 W	1	RCR07G820JS	81349	01121
R3*	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	4	RCR07G100JS	81349	01121
R4	Resistor, Fixed, Composition: 1.8 kΩ, 5%, 1/4 W	1	RCR07G182JS	81349	01121
R5	Resistor, Fixed, Composition: 56 Ω, 5%, 1/4 W	1	RCR07G560JS	81349	01121
R6	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	01121
R7	Same as R1				
R8	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	3	RCR07G102JS	81349	01121
R9	Resistor, Fixed, Composition: 200 Ω, 5%, 1/4 W	1	RCR07G201JS	81349	01121
R10	Same as R3				
R11	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R12	Resistor, Fixed, Composition: 4.7 Ω, 5%, 1/4 W	1	RCR07G4R7JS	81349	01121
R13	Resistor, Fixed, Composition: 68 Ω, 5%, 1/4 W	2	RCR07G680JS	81349	01121
R14	Resistor, Fixed, Composition: 390 Ω, 5%, 1/4 W	1	RCR07G391JS	81349	01121
R15	Same as R13				
R16	Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W	1	RCR07G272JS	81349	01121
R17	Same as R8				
R18	Same as R3				
R19	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	1	RCR07G220JS	81349	01121
R20	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R21	Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W	1	RCR07G561JS	81349	01121
R22	Resistor, Fixed, Composition: 150 Ω, 5%, 1/4 W	2	RCR07G151JS	81349	01121
R23	Resistor, Fixed, Composition: 15 Ω, 5%, 1/4 W	1	RCR07G150JS	81349	01121
R24	Same as R8				
R25	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	1	RCR07G471JS	81349	01121
R26	Resistor, Fixed, Composition: 330 Ω, 5%, 1/4 W	1	RCR07G331JS	81349	01121
R27	Same as R3				
R28	Resistor, Fixed, Composition: 12 Ω, 5%, 1/4 W	1	RCR07G120JS	81349	01121
R29	Same as R22				
RA1	Heatsink	1	1118C	13103	
T1	Transformer Assembly	1	22295-53	14632	
T2	Transformer Assembly	1	22295-54	14632	
T3	Transformer Assembly	1	22295-56	14632	
T4	Transformer Assembly	1	22295-55	14632	
U1	Mixer, Balanced: 0.05-200 MHz	1	M9A	27956	
	* Nominal value, final value factory selected.				

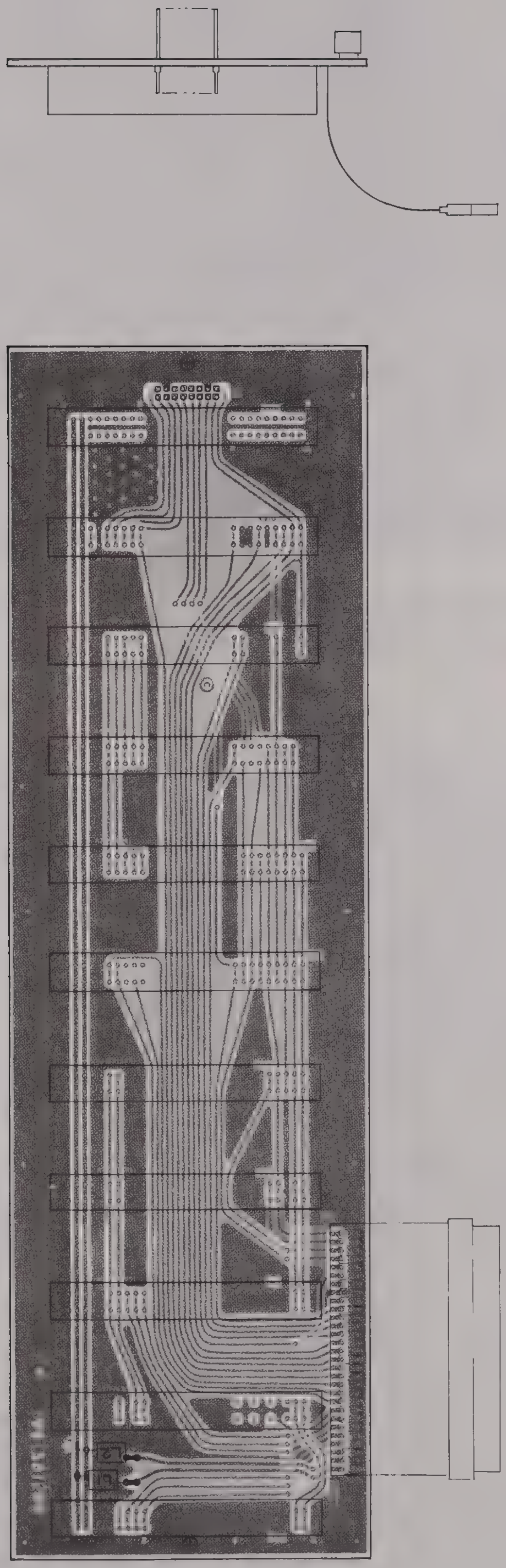


Figure 5-10. Type 791569 I/F Mother Bd (A4), Location of Components

5.5.4 TYPE 791569 IF MOTHERBOARD REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	10.7 MHz Filter Switch	1	791594	14632	
A2	10.7 MHz, 455 kHz Converter	1	71430	14632	
A3	455 kHz Filter Switch	1	791595	14632	
A4	USB Filter Switch	1	791596	14632	
A5	ISB, LSB Filter Switch	1	791597	14632	
A6	AGC	1	78112	14632	
A7	455 kHz Amplifier, AM Detector	1	72488	14632	
A8	ISB Detector and Audio	1	791598	14632	
A9	FM, CW & SSB Detector	1	791599	14632	
A10	Audio Switch and Amplifier	1	7459	14632	
A11	Spare				
C1	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	29	34453-1	14632	
C2 Thru C29	Same as C1				
J1	Feedthru Post	2	117820-3	00779	
J2	Same as J1				
L1	Ferrite Choke	2	VK200-10-3B	02114	
L2	Same as L1				
P1	Cable	1	5107-902-1	00779	
XA1	Contact Strip	11	PE7-14046	00779	
XA2 Thru XA11	Same as XA1				

5.5.4.1 Type 791594 10.7 MHz Filter SW REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	28	34453-1	14632	
C2 Thru C8	Same as C1				
C9	Calacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	56289
C10	Same as C1				
C11	Same as C1				
C12	Not Used				
C13 Thru C30	Same as C1				
C31	Capacitor, Mica, Dipped: 68 pF, 2%, 500 V	1	CM05ED680G03	81349	72136
C32	Capacitor, Mica, Dipped: 130 pF, 2%, 500 V	1	CM05FD131G03	81349	72136
C33	Capacitor, Mica, Dipped: 51 pF, 2%, 500 V	2	CM05ED510G03	81349	72136
C34	Same as C33				
FL1	Filter	1	92126	14632	
FL2	Filter	1	92125	14632	
L1	Coil, Fixed: 33 μH	1	1537-52	99800	
L2	Coil, Fixed: 2.2 μH	1	1537-20	99800	
L3	Coil, Fixed, Mold: 1.8 μH	1	1537-18	99800	
Q1	Transistor	6	841001-1	14632	
Q2 Thru Q6	Same as Q1				
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	10	RCR07G103JS	81349	01121
R2	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	3	RCR07G122JS	81349	01121
R3	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	9	RCR07G474JS	81349	01121
R4	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	2	RCR07G821JS	81349	01121
R5	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	6	RCR07G100JS	81349	01121
R6	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	5	RCR07G220JS	81349	01121
R7	Resistor, Variable, Film: 200 Ω, 10%, 1/2 W	3	62PR200	73138	
R8	Same as R3				
R9	Same as R1				
R10	Same as R6				
R11	Same as R3				
R12	Resistor, Fixed, Composition: 56 Ω, 5%, 1/4 W	1	RCR07G560JS	81349	01121
R13	Same as R5				
R14	Resistor, Fixed, Composition: 68 Ω, 5%, 1/4 W	6	RCR07G680JS	81349	01121

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R15	Same as R6				
R16	Same as R6				
R17	Same as R1				
R18	Same as R3				
R19	Same as R5				
R20	Same as R14				
R21	Same as R4				
R22	Same as R7				
R23	Same as R3				
R24	Same as R1				
R25	Same as R3				
R26	Same as R5				
R27	Same as R14				
R28	Same as R1				
R29	Same as R2				
R30	Same as R1				
R31	Same as R3				
R32	Same as R14				
R33	Same as R14				
R34	Resistor, Fixed, Composition: 180 Ω, 5%, 1/4 W	2	RCR07G181JS	81349	01121
R35	Not Used				
R36	Same as R5				
R37	Same as R6				
R38	Resistor, Fixed, Composition: 200 Ω, 5%, 1/4 W	1	RCR07G201JS	81349	01121
R39	Same as R7				
R40	Same as R3				
R41	Same as R1				
R42	Same as R3				
R43	Same as R5				
R44	Same as R14				
R45	Same as R34				
R46	Same as R2				
R47 Thru R49	Same as R1				
R50	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	01121

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
T1	Transformer	2	70449	52748	
T2	Same as T1				

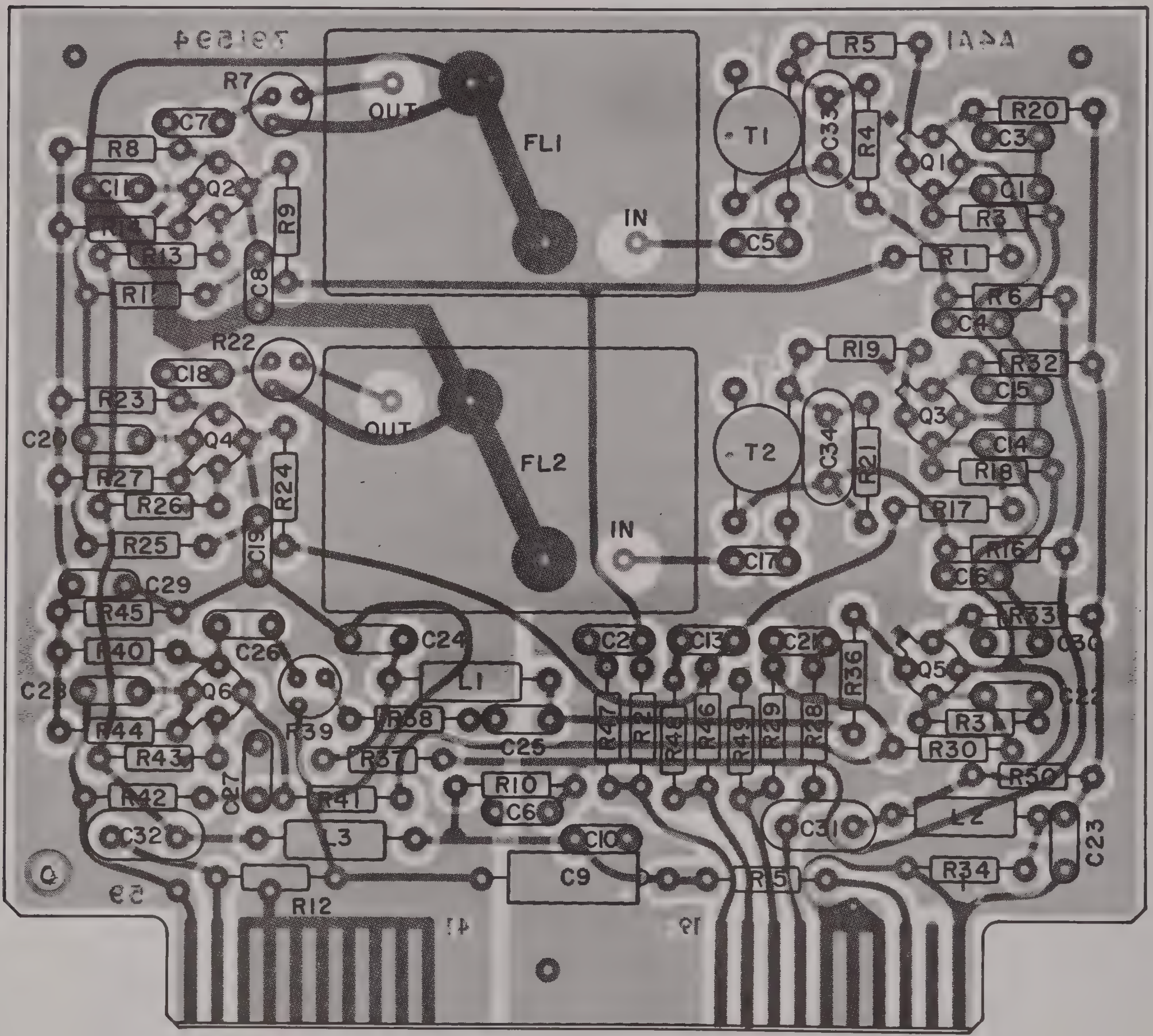

791594
A4A1
R7
C7
OUT
FL1
IN
C5
R5
T1
C33
R4
R20
C3
Q1
C1
R3
R1
R6
C4
R8
C11
Q2
R9
R13
R11
C8
R22
C18
OUT
FL2
IN
C17
T2
C34
R21
R19
R32
C15
Q3
C14
R18
R17
R16
C16
R23
C20
Q4
R27
R24
R26
R25
C19
C29
R45
R40
C26
C24
L1
C2
C13
C21
R36
Q5
R33
C30
C28
Q6
R44
R39
R38
R47
R48
R46
R49
R29
R28
C22
R31
R30
R43
C25
R37
C27
R42
R41
R10
C6
R50
C31
L2
C23
C32
L3
C10
C9
R15
R34
R12
59
41
19

Figure 5-11. Type 791594 10.7 MHz Filter Switch (A4A1), Location of Components

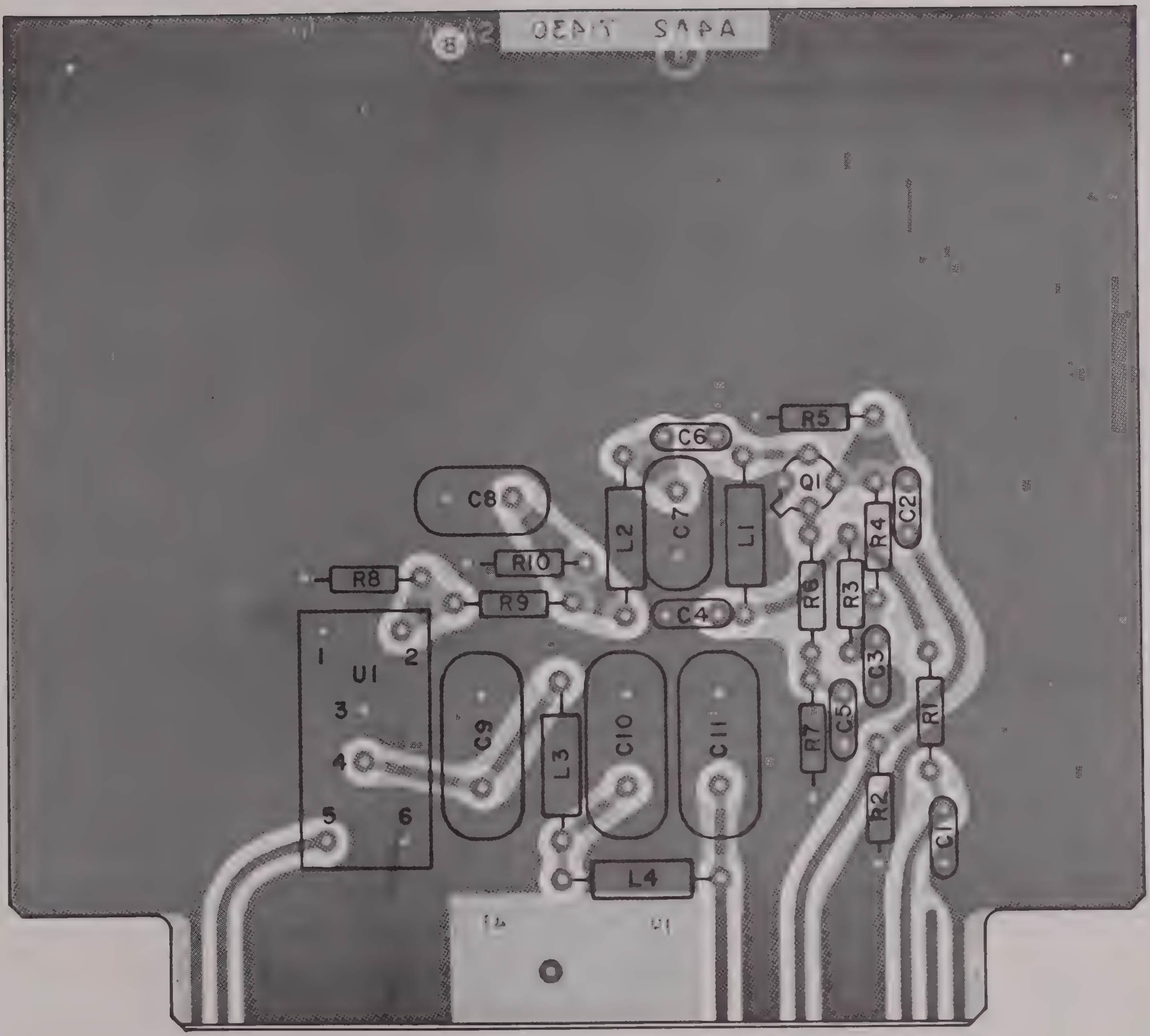

R5
C6
Q1
C8
L2
C7
L1
R4
C2
R10
R8
R9
R6
R3
C4
1
2
U1
3
4
5
6
C9
L3
C10
C11
C3
R7
C5
R1
R2
C1
L4

Figure 5-12. Type 71430 10.7 MHz/455 kHz Converter (A4A2), Location of Components

5.5.4.2 Type 71430 10.7 MHz, 455 kHz Converter REF DESIG PREFIX A4A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	6	34453-1	14632	
C2 Thru C6	Same as C1				
C7	Capacitor, Mica, Dipped: 68 pF, 2%, 500 V	1	CM05ED680G03	81349	72136
C8	Capacitor, Mica, Dipped: 360 pF, 2%, 500 V	1	CM05FD361G03	81349	72136
C9	Capacitor, Mica, Dipped: 3900 pF, 2%, 500 V	2	CM06FD392G03	81349	72136
C10	Same as C9				
C11	Capacitor, Mica, Dipped: 1600 pF, 2%, 500 V	1	CM06FD162G03	81349	72136
L1	Coil, Fixed: 100 μH	1	1537-76	99800	
L2	Coil, Fixed: 3.3 μH	1	1537-24	99800	
L3	Coil, Fixed: 12 μH	1	1537-38	99800	
L4	Coil, Fixed: 82 μH	1	1537-72	99800	
Q1	Transistor	1	2N2708/JAN	81350	
R1	Resistor, Fixed, Composition: 56 Ω, 5%, 1/4 W	2	RCR07G560JS	81349	01121
R2	Same as R1				
R3	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	01121
R4	Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W	1	RCR07G123JS	81349	01121
R5	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R6	Resistor, Fixed, Composition: 39 Ω, 5%, 1/4 W	1	RCR07G390JS	81349	01121
R7	Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W	1	RCR07G561JS	81349	01121
R8	Resistor, Fixed, Composition: 300 Ω, 5%, 1/4 W	2	RCR07G301JS	81349	01121
R9	Resistor, Fixed, Composition: 18 Ω, 5%, 1/4 W	1	RCR07G180JS	81349	01121
R10	Same as R8				
U1	Mixer, Balanced	1	M6A	27956	

5.5.4.3 Type 791595 455 kHz Filter Switch REF DESIG PREFIX A4A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	19	34452-1	14632	
C2 Thru C7	Same as C1				
C8	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	
C9 Thru C20	Same as C1				
FL1	Filter	1	92128	14632	
FL2	Filter	1	92127	14632	
L1	Coil, Fixed: 6.8 mH	3	553-3635-47	71279	
L2	Same as L1				
L3	Same as L1				
Q1	Transistor	6	2N2222A	80131	04713
Q2 Thru Q6	Same as Q1				
R1	Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W	4	RCR07G223JS	81349	01121
R2	Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W	3	RCR07G392JS	81349	01121
R3	Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W	3	RCR07G271JS	81349	01121
R4	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	3	RCR07G122JS	81349	01121
R5	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	3	RCR07G220JS	81349	01121
R6	Same as R5				
R7	Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W	3	RCR07G123JS	81349	01121
R8	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W	3	RCR07G152JS	81349	01121
R9	Resistor, Fixed, Composition: 150 Ω, 5%, 1/4 W	3	RCR07G151JS	81349	01121
R10	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	2	RCR07G221JS	81349	01121
R11	Same as R5				
R12	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	5	RCR07G103JS	81349	01121
R13	Same as R1				
R14	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	7	RCR07G101JS	81349	01121
R15	Same as R14				
R16	Same as R12				
R17	Same as R1				
R18	Same as R2				
R19	Same as R3				
R20	Same as R4				
R21	Same as R7				

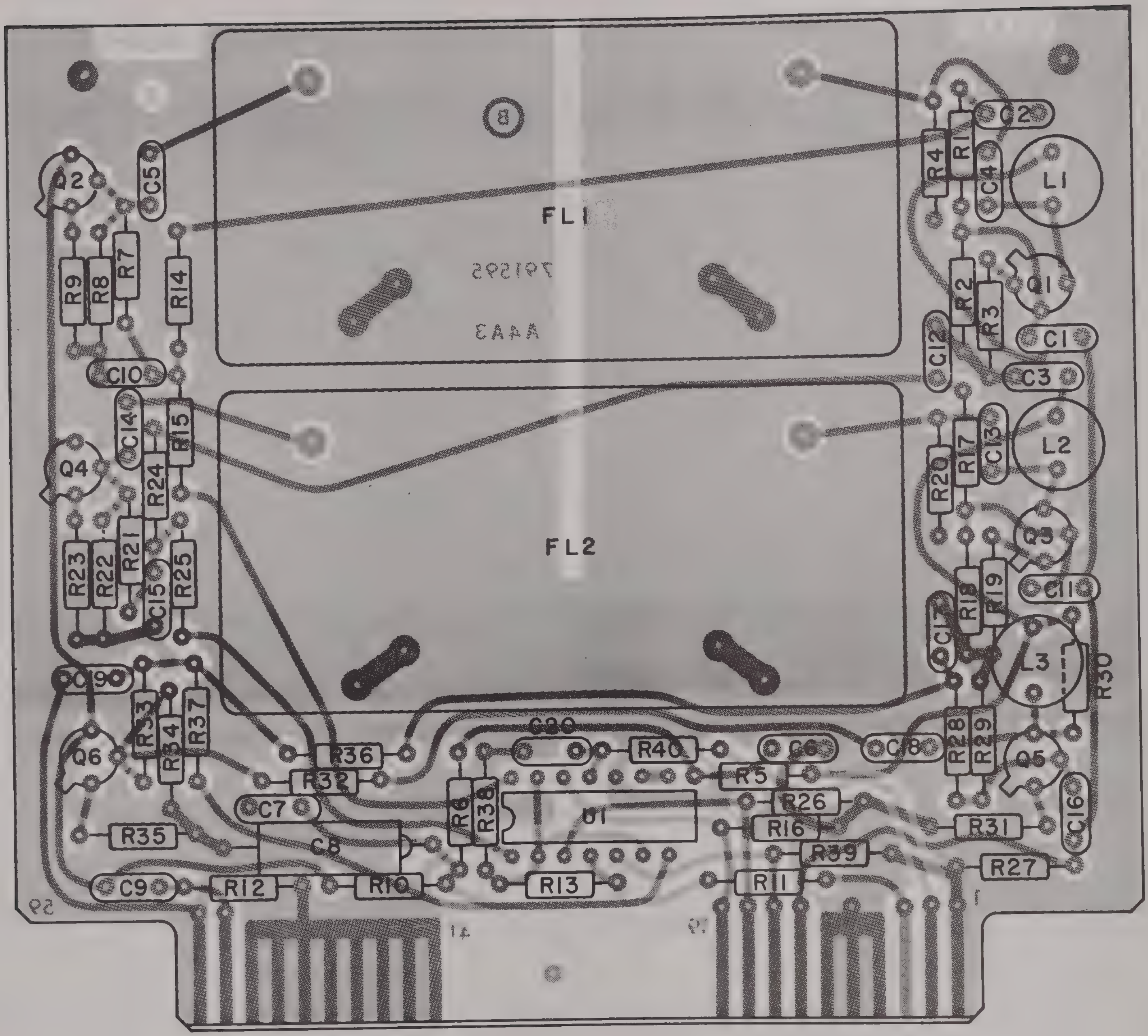

FL1
FL2
L1
L2
L3
Q1
Q2
Q3
Q4
Q5
Q6
U1
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40

Figure 5-13. Type 791595 455 kHz Filter Switch (A4A3), Location of Components

REF DESIG PREFIX A4A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R22	Same as R8				
R23	Same as R9				
R24	Same as R14				
R25	Same as R14				
R26	Same as R12				
R27	Same as R12				
R28	Same as R1				
R29	Same as R2				
R30	Same as R4				
R31	Same as R3				
R32	Same as R10				
R33	Same as R7				
R34	Same as R8				
R35	Same as R9				
R36	Same as R14				
R37	Same as R14				
R38	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R39	Same as R12				
R40	Same as R14				
U1	Integrated Circuit	1	MC3403P	04713	

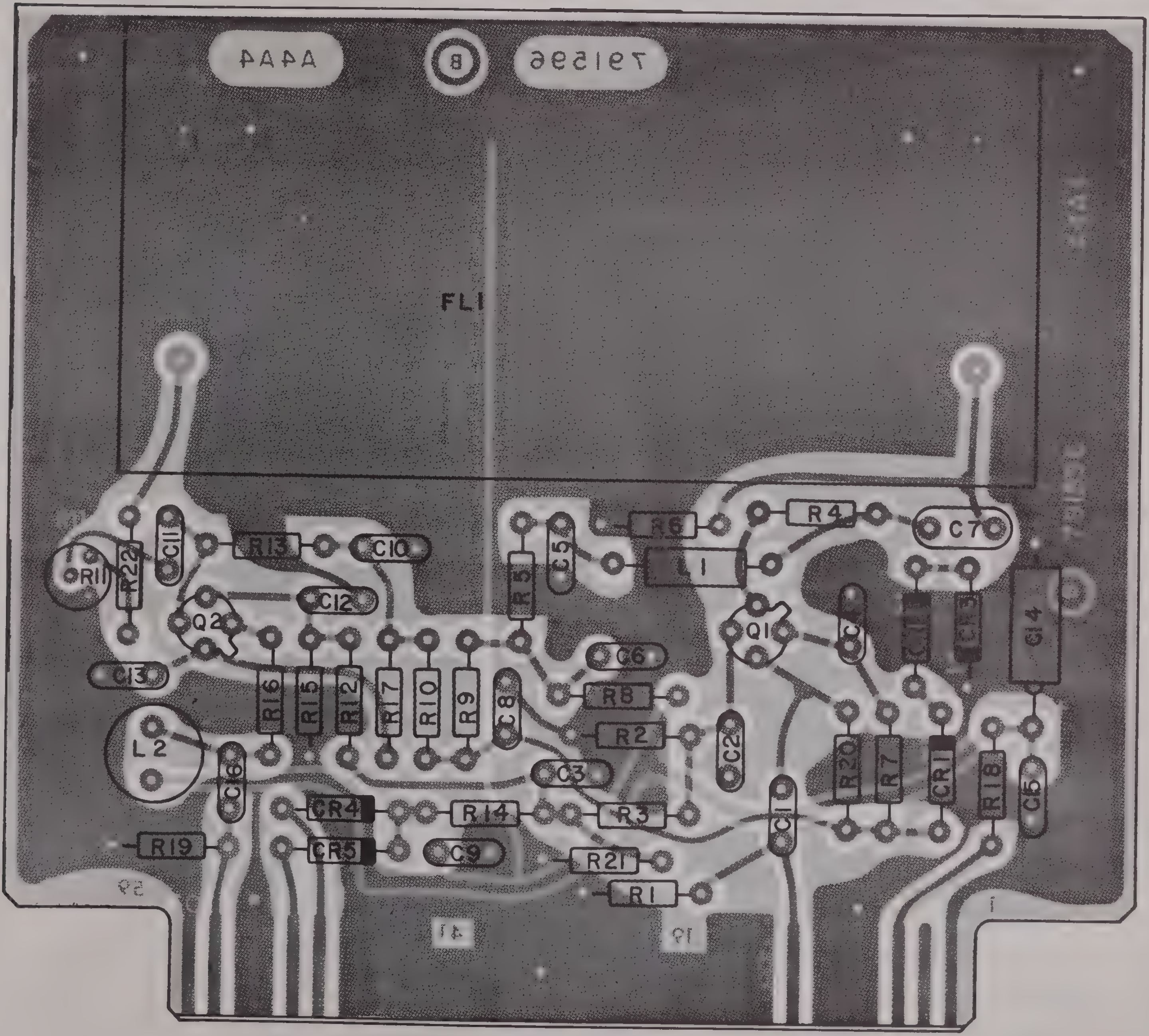
5.5.4.4 Type 791596 USB Filter Switch

REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	12	34452-1	14632	
C2	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	1	34475-1	14632	
C3 Thru C6	Same as C1				
C7	Capacitor, Mica, Dipped: 270 pF, 2%, 500 V	1	CM05FD271G03	81349	72136
C8 Thru C13	Same as C1				
C14	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	56289
C15	Same as C1				
C16	Same as C1				
CR1	Diode	5	1N4449	80131	93332
CR2 Thru CR5	Same as CR1				
FL1	Filter	1	92122	14632	
L1	Coil, Fixed, Mold: 470 μH	1	2500-12	99800	
L2	Coil, Fixed: 6.8 mH	1	553-3635-47	71279	
Q1	Transistor	2	841001-1	14632	
Q2	Same as Q1				
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	6	RCR07G103JS	81349	01121
R2	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	3	RCR07G474JS	81349	01121
R3	Same as R1				
R4	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	2	RCR07G100JS	81349	01121
R5	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	3	RCR07G220JS	81349	01121
R6	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	1	RCR07G122JS	81349	01121
R7	Resistor, Fixed, Composition: 68 Ω, 5%, 1/4 W	3	RCR07G680JS	81349	01121
R8	Same as R5				
R9	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R10	Same as R7				
R11	Resistor, Variable, Film: 1 kΩ, 10%, 1/2 W	1	62PR1K	73138	
R12	Same as R1				
R13	Same as R2				
R14	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	
R15	Same as R2				
R16	Same as R4				
R17	Same as R7				

REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R18	Same as R5				
R19 Thru R21	Same as R1				
R22	Resistor, Fixed, Composition: 200 Ω, 5%, 1/4 W	1	RCR07G201JS	81349	01121


FL1
R6
R4
C7
C5
L1
R13
C10
C11
R22
R11
C12
Q2
R5
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C4
C14
C13
C6
R8
R16
R15
R12
R17
R10
R9
C8
R2
C2
L2
C16
C3
R20
R7
CR1
R18
C15
CR4
R14
R3
C1
R19
CR5
C9
R21
R1

Figure 5-14. Type 791596 USB Filter Switch (A4A4), Location of Components

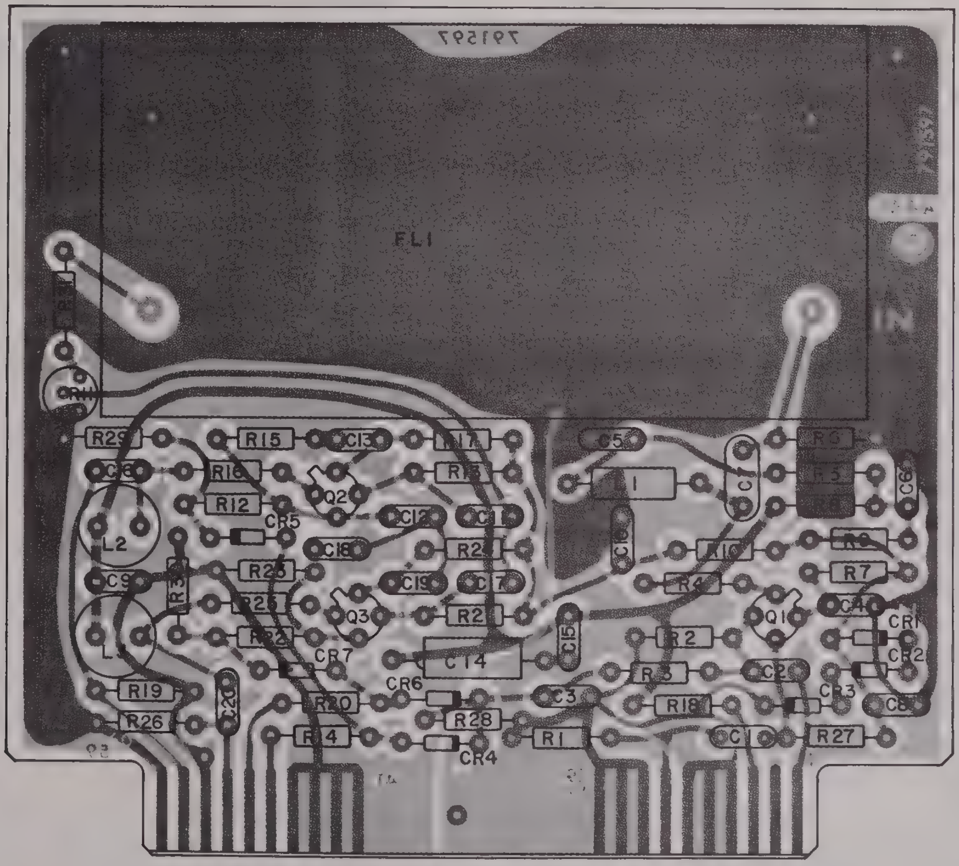
5.5.4.5 Type 791597 ISB, LSB Filter Switch

REF DESIG PREFIX A4A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	18	34452-1	14632	
C2 Thru C6	Same as C1				
C7	Capacitor, Mica, Dipped: 270 pF, 2%, 500 V	1	CM05FD271G03	81349	72136
C8 Thru C13	Same as C1				
C14	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	56289
C15 Thru C20	Same as C1				
CR1	Diode	7	1N4449	80131	93332
CR2 Thru CR7	Same as CR1				
FL1	Filter	1	92121	14632	
L1	Coil, Fixed, Mold: 470 μH	1	2500-12	99800	
L2	Coil, Fixed: 6.8 mH	2	553-3635-47	71279	
L3	Same as L2				
Q1	Transistor	3	841001-1	14632	
Q2	Same as Q1				
Q3	Same as Q1				
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	10	RCR07G103JS	81349	01121
R2	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	5	RCR07G474JS	81349	01121
R3	Same as R1				
R4	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	3	RCR07G100JS	81349	01121
R5	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	3	RCR07G220JS	81349	01121
R6	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	1	RCR07G122JS	81349	01121
R7	Resistor, Fixed, Composition: 68 Ω, 5%, 1/4 W	4	RCR07G680JS	81349	01121
R8	Same as R5				
R9	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R10	Same as R7				
R11	Resistor, Variable, Film: 1 kΩ, 10%, 1/2 W	1	62PR1K	73138	
R12	Same as R1				
R13	Same as R2				
R14	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	2	RCR07G101JS	81349	01121
R15	Same as R2				

REF DESIG PREFIX A4A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R16	Same as R4				
R17	Same as R7				
R18	Same as R5				
R19	Same as R1				
R20	Same as R14				
R21	Same as R2				
R22	Same as R1				
R23	Same as R2				
R24	Same as R7				
R25	Same as R4				
R26 Thru R30	Same as R1				
R31	Resistor, Fixed, Composition: 200 Ω, 5%, 1/4 W	1	RCR07G201JS	81349	01121


791597
FL1
R29
R15
C13
R17
C5
C8
R16
R13
Q2
R6
R5
C7
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CR5
C12
C11
L2
C18
R24
C16
R10
R8
C9
R25
C19
C17
R4
R7
R30
R23
Q3
R21
C15
Q1
C4
CR1
R22
R2
CR2
L3
CR7
C14
R3
C2
CR6
CR3
R19
C20
R20
C3
R18
C8
R26
R28
R14
R1
C1
R27
CR4

Figure 5-15. Type 791597 ISB, LSB Filter Switch (A4A5), Location of Components

5.5.4.6 Type 78112 AGC Amplifier REF DESIG PREFIX A4A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Electrolytic, Tantalum: 47 μF, 10%, 20 V	2	CS13BE476K	81349	56289
C2	Not Used				
C3	Capacitor, Ceramic, Disc: 0.47 μH, 20%, 50 V	2	34452-1	14632	
C4	Capacitor, Electrolytic, Tantalum: 33 μF, 0.10%, 10 V	1	CS138C336K	81349	56289
C5	Same as C3				
C6	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	1	34475-1	14632	
C7	Same as C1				
C8	Not Used				
CR1	Not Used				
CR2	Diode, Zener: 5.6 V	1	1N752A	80131	04713
CR3	Not Used				
CR4	Not Used				
CR5	Diode	4	1N4449	80131	93332
CR6 Thru CR8	Same as CR5				
E1	Terminal, Forked	4	140-1019-02-01	71279	
E2 Thru E4	Same as E1				
Q1	Transistor	6	2N2222A	80131	04713
Q2	Transistor	1	2N2907/JAN	81350	04713
Q3 Thru Q7	Same Same as Q1				
R1	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	3	RCR07G104JS	81349	01121
R2	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	4	RCR07G473JS	81349	01121
R3	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	2	RCR07G474JS	81349	01121
R4	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	5	RCR07G101JS	81349	01121
R5	Not Used				
R6	Resistor, Fixed, Composition: 330 kΩ, 5%, 1/4 W	1	RCR07G334JS	81349	01121
R7	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	4	RCR07G682JS	81349	01121
R8	Same as R4				
R9	Resistor, Fixed, Composition: 15 kΩ, 5%, 1/4 W	5	RCR07G153JS	81349	01121
R10	Resistor, Fixed, Composition: 150 kΩ, 5%, 1/4 W	1	RCR07G154JS	81349	01121
R11	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	5	RCR07G103JS	81349	01121
R12	Resistor, Fixed, Composition: 82 kΩ, 5%, 1/4 W	1	RCR07G823JS	81349	01121
R13	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	01121

REF DESIG PREFIX A4A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R14	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	1	RCR07G122JS	81349	01121
R15	Same as R7				
R16	Same as R7				
R17	Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W	1	RCR07G223JS	81349	01121
R18	Resistor, Fixed, Composition: 270 kΩ, 5%, 1/4 W	1	RCR07G274JS	81349	01121
R19	Resistor, Fixed, Composition: 680 kΩ, 5%, 1/4 W	1	RCR07G684JS	81349	01121
R20	Same as R11				
R21	Same as R9				
R22	Same as R9				
R23	Same as R3				
R24	Same as R9				
R25	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W	1	RCR07G152JS	81349	01121
R25	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	1	RCR07G222JS	81349	01121
R27	Same as R11				
R28	Same as R4				
R29	Same as R4				
R30	Same as R11				
R31	Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W	1	RCR07G272JS	81349	01121
R32	Resistor, Fixed, Composition: 390 Ω, 5%, 1/4 W	2	RCR07G391JS	81349	01121
R33	Same as R2				
R34	Not Used				
R35	Same as R2				
R36	Resistor, Fixed, Composition: 68 kΩ, 5%, 1/4 W	3	RCR07G683JS	81349	01121
R37	Same as R1				
R38	Same as R36				
R39	Same as R36				
R40	Same as R1				
R41	Same as R7				
R42	Same as R4				
R43	Same as R2				
R44	Not Used				
R45	Same as R11				
R46*	Resistor, Fixed, Composition: 39 kΩ, 5%, 1/4 W	1	RCR07G393JS	81349	01121
R47	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	1	RCR07G821JS	81349	01121
R48	Resistor, Fixed, Composition: 68 Ω, 5%, 1/4 W	1	RCR07G680JS	81349	01121
	* Nominal value, final value factory selected				

REF DESIG PREFIX A4A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R49	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	01121
R50	Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W	1	RCR07G392JS	81349	01121
R51	Same as R32				
U1	Integrated Circuit	2	MC3403P	04713	
U2	Same as U1				

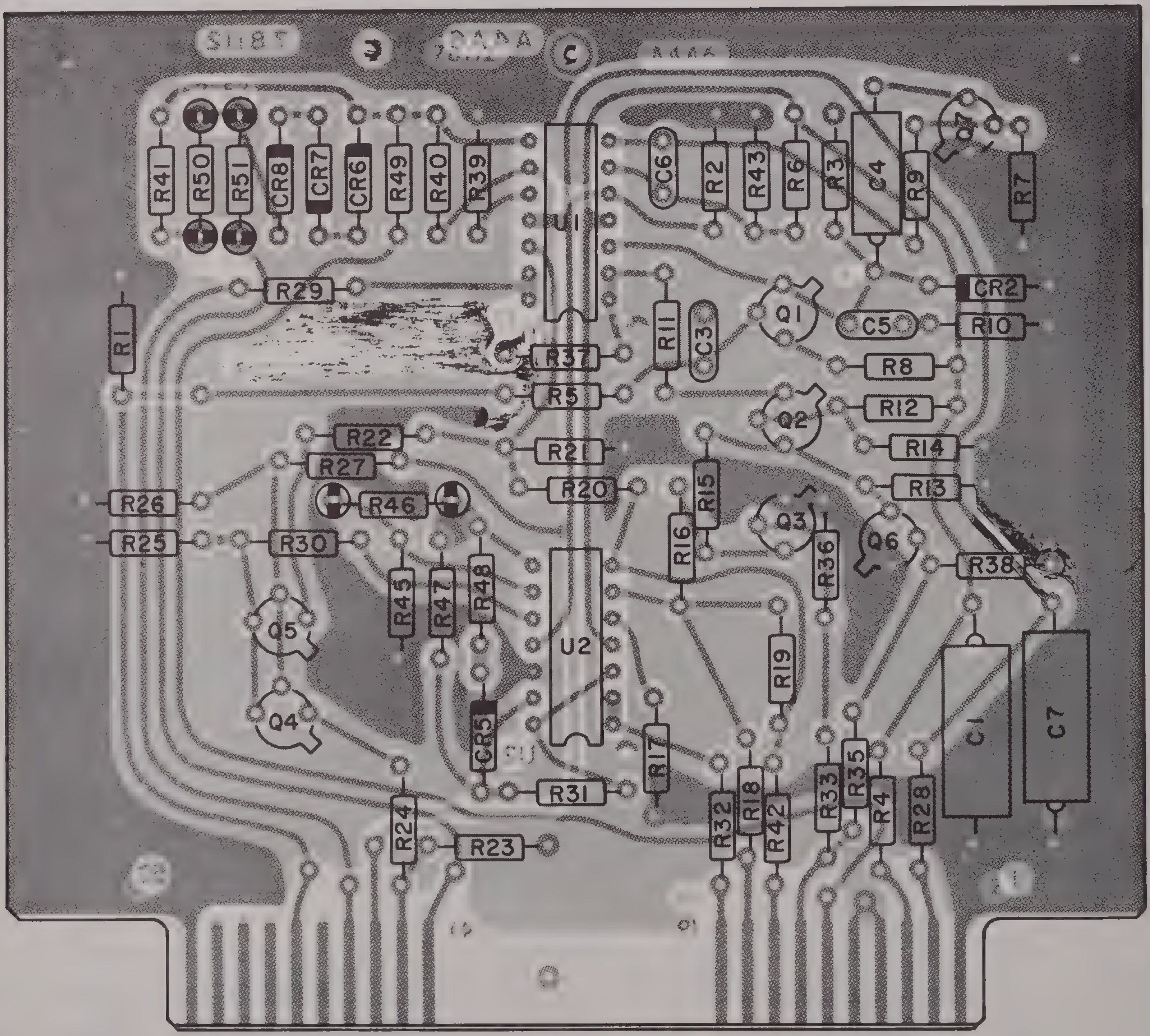

78112
A4A6
R41
R50
R51
CR8
CR7
CR6
R49
R40
R39
U1
C6
R2
R43
R6
R3
C4
R9
Q7
R7
R29
R1
R11
C3
Q1
CR2
C5
R10
R37
R8
R5
Q2
R12
R22
R21
R14
R27
R20
R15
R13
R26
R46
Q3
Q6
R25
R30
R16
R36
R38
R45
R47
R48
U2
Q5
R19
C1
C7
Q4
CR5
R17
R31
R32
R18
R42
R33
R35
R4
R28
R24
R23

Figure 5-16. Type 78112 AGC Amplifier (A4A6), Location of Components

5.5.4.7 Type 72488 455 kHz Amplifier and AM Detector REF DESIG PREFIX A4A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	21	34452-1	14632	
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	3	34453-1	14632	
C4 Thru C6	Same as C1				
C7	Same as C3				
C8	Same as C1				
C9	Capacitor, Mica, Dipped: 3300 pF, 2%, 500 V	2	CM06FD332G03	81349	72136
C10	Capacitor, Mica, Dipped: 180 pF, 2%, 500 V	2	CM05FD181G03	81349	72136
C11	Same as C9				
C12 Thru C20	Same as C1				
C21	Not Used				
C22 Thru C25	Same as C1				
C26	Same as C10				
C27	Same as C1				
C28	Same as C3				
C29	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	56289
C30	Same as C1				
CR1	Diode	5	1N4449	80131	93332
CR2 Thru CR5	Same as CR1				
L1	Coil, Fixed: 6.8 mH	5	553-3635-47	71279	
L2	Coil, Variable: 39 mH	2	558-7107-32	71279	
L3	Same as L2				
L4 Thru L7	Same as L1				
Q1	Transistor	2	841001-1	14632	
Q2	Same as Q1				
Q3	Transistor	4	2N2222A	80131	04713
Q4 Thru Q6	Same as Q3				
R1	Resistor, Fixed, Composition: 33 kΩ, 5%, 1/4 W	1	RCR07G333JS	81349	01121

REF DESIG PREFIX A4A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R2	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	2	RCR07G222JS	81349	01121
R3	Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W	2	RCR07G392JS	81349	01121
R4	Resistor, Fixed, Composition: 39 kΩ, 5%, 1/4 W	2	RCR07G393JS	81349	01121
R5	Resistor, Fixed, Composition: 120 kΩ, 5%, 1/4 W	2	RCR07G124JS	81349	01121
R6	Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W	2	RCR07G271JS	81349	01121
R7	Resistor, Variable, Film: 5 kΩ, 10%, 1/2 W	1	62PAR5K	73138	
R8	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	2	RCR07G221JS	81349	01121
R9	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	6	RCR07G101JS	81349	01121
R10	Resistor, Fixed, Composition: 680 kΩ, 5%, 1/4 W	1	RCR07G684JS	81349	01121
R11	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	2	RCR07G473JS	81349	01121
R12	Same as R3				
R13	Same as R4				
R14	Same as R6				
R15	Not Used				
R16	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	2	RCR07G470JS	81349	01121
R17	Resistor, Fixed, Composition: 8.2 kΩ, 5%, 1/4 W	1	RCR07G822JS	81349	01121
R18	Same as R9				
R19	Same as R9				
R20	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	01121
R21	Same as R9				
R22	Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W	1	RCR07G123JS	81349	01121
R23	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R24	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	1	RCR07G220JS	81349	01121
R25	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	1	RCR07G471JS	81349	01121
R26	Resistor, Fixed, Composition: 15 Ω, 5%, 1/4 W	1	RCR07G150JS	81349	01121
R27	Resistor, Fixed, Composition: 150 Ω, 5%, 1/4 W	1	RCR07G151JS	81349	01121
R28	Same as R5				
R29	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W	1	RCR07G152JS	81349	01121
R30	Same as R2				
R31	Same as R9				
R32	Same as R8				
R33	Resistor, Fixed, Composition: 1.8 kΩ, 5%, 1/4 W	1	RCR07G182JS	81349	01121
R34	Same as R9				
R35	Resistor, Fixed, Composition: 5.6 kΩ, 5%, 1/4 W	1	RCR07G562JS	81349	01121
R36	Same as R11				
R37	Same as R16				

REF DESIG PREFIX A4A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R38	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	1	RCR07G682JS	81349	01121
R39	Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W	1	RCR07G561JS	81349	01121
T1	XFMR/Coupling, Wide-Band	1	70-130	06978	

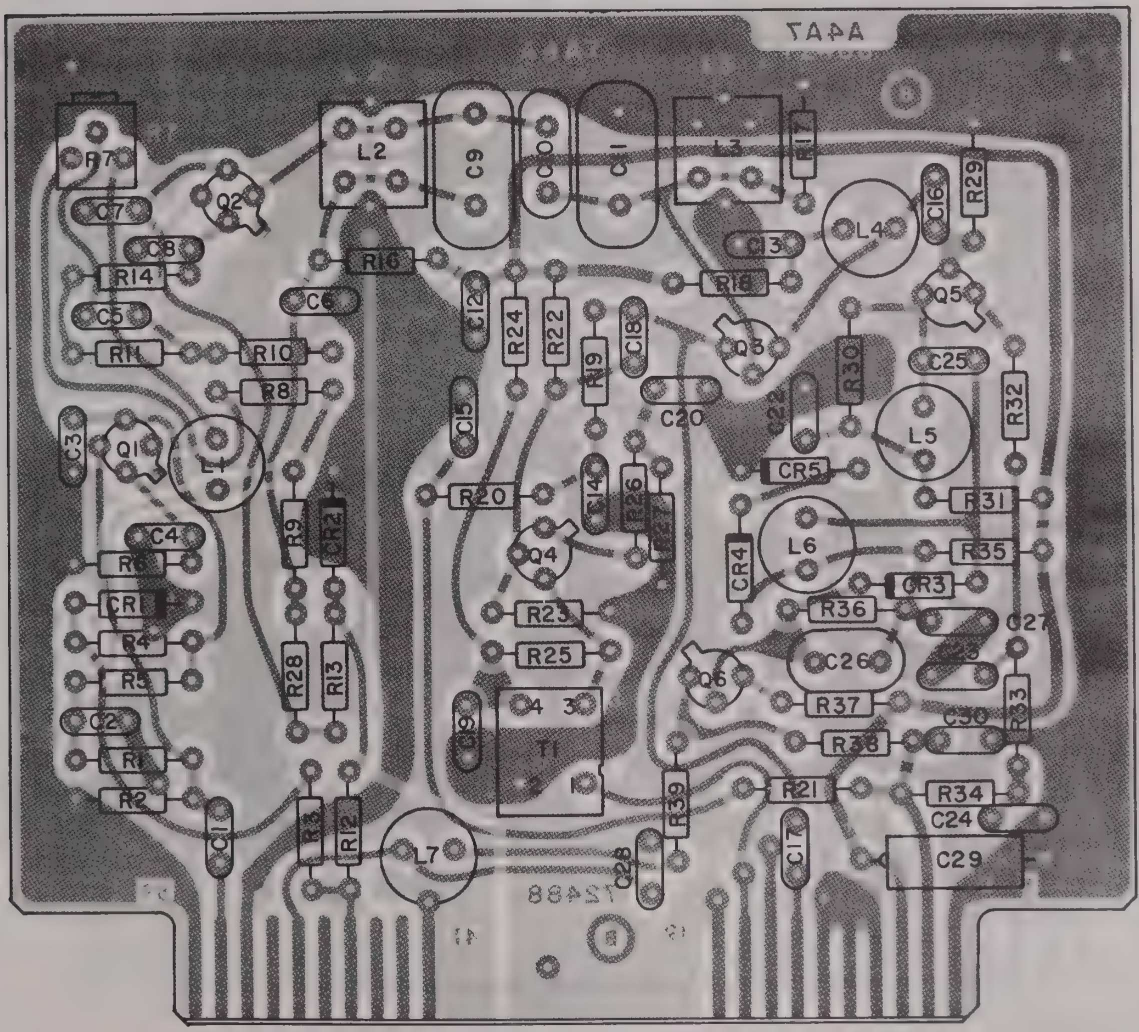

A4A7
R7
L2
C9
C10
C11
L3
R17
R29
C16
C7
Q2
C8
R14
R16
C13
L4
R18
C6
C5
C12
R24
R22
C18
Q5
Q3
R11
R10
R8
R19
R30
C25
C20
C22
R32
C15
C3
Q1
L1
L5
CR5
R20
C14
R26
R27
R31
R9
CR2
C4
Q4
CR4
L6
R35
R6
CR1
CR3
R36
C27
R23
R4
R25
C26
C23
R5
R28
R13
Q6
R37
C2
C19
4
3
T1
2
1
C30
R33
R1
R38
R39
R21
R34
R2
C24
C1
R3
R12
L7
C28
C17
C29
72488

Figure 5-17. Type 72488 455 kHz Amplifier & AM Detector (A4A7), Location of Components

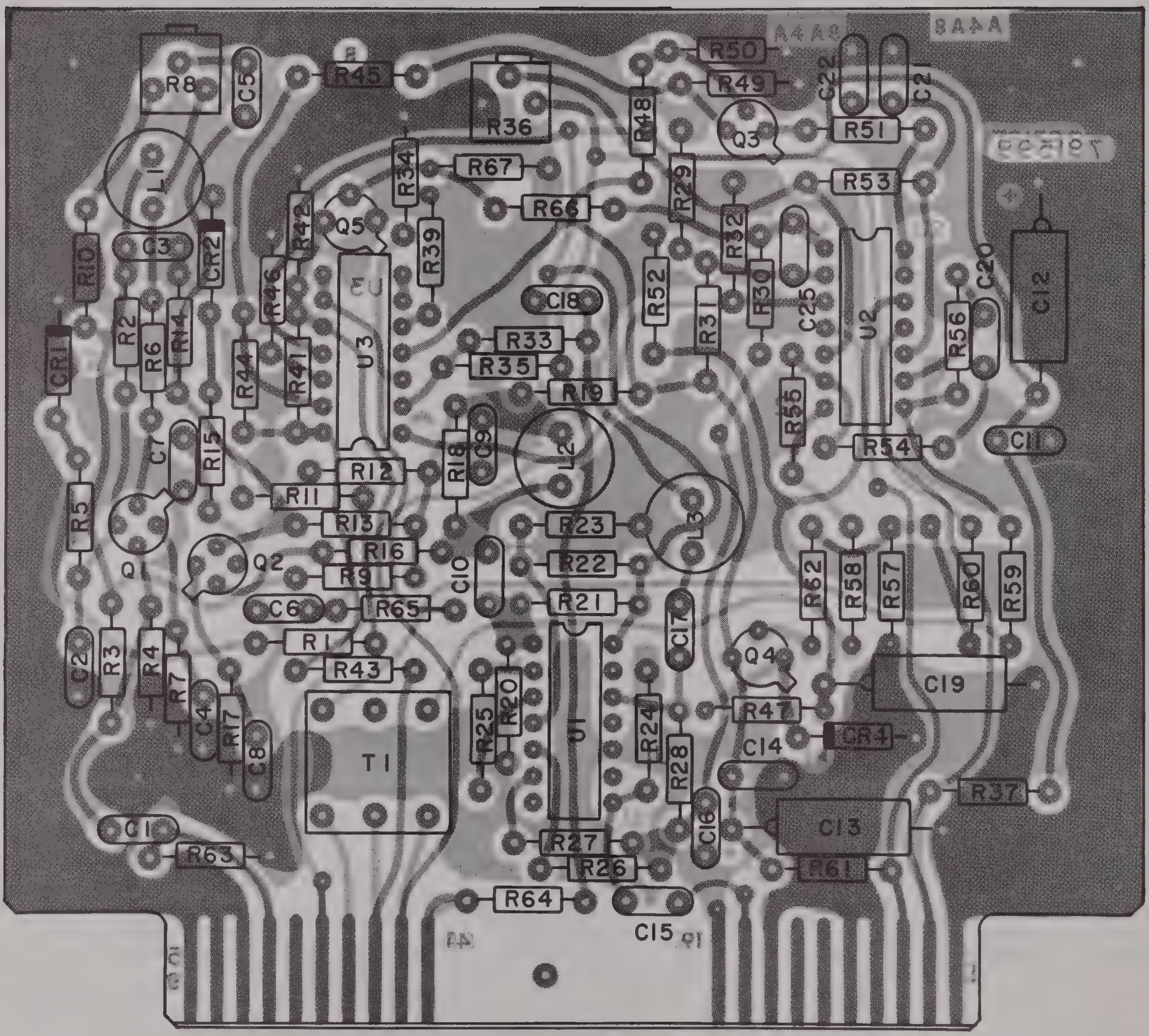

R8
C5
R45
R36
R50
A4A8
R49
C22
C21
R48
Q3
R51
L1
R34
R67
R53
R66
R29
Q5
R42
C3
CR2
R10
R39
R32
R46
U3
C18
R52
R30
C25
U2
C20
C12
R2
R6
R14
CR1
R44
R41
R33
R31
R35
R56
R19
R55
C7
R15
R12
R18
C9
L2
R54
C11
R5
R11
R13
R23
L3
Q1
Q2
R16
R9
C10
R22
R62
R58
R57
R60
R59
C6
R65
R21
C17
R1
Q4
C2
R3
R4
R7
R43
C19
C4
R17
R20
R25
U1
R24
R47
C8
T1
R28
CR4
C14
R37
C1
C13
R27
C16
R63
R26
R61
R64
C15

Figure 5-18. Type 791598 ISB Detector & Audio (A4A8), Location of Components

5.5.4.8 Type 791598 ISB Detector/Audio REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	19	34452-1	14632	
C2 Thru C11	Same as C1				
C12	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	2	CS13BE156K	81349	56289
C13	Same as C12				
C14 Thru C17	Same as C1				
C18	Capacitor, Ceramic, Disc: 3300 pF, 10%, 200 V	1	CK06BX332K	81349	56289
C19	Capacitor, Electrolytic, Tantalum: 4.7 μF, 10%, 35 V	1	CS13BF475K	81349	56289
C20	Same as C1				
C21	Same as C1				
C22	Same as C1				
C23	Not Used				
C24	Not Used				
C25	Same as C1				
CR1	Diode	3	1N4449	80131	93332
CR2	Same as CR1				
CR3	Not Used				
CR4	Same as CR1				
L1	Coil, Fixed: 6.8 mH	2	553-3635-47	71279	
L2	Same as L1				
L3	Coil, Fixed,: 47 mH	1	553-3635-57	71279	
Q1	Transistor	2	841001-1	14632	
Q2	Same as Q1				
Q3	Transistor	2	2N2907/JAN	81350	04713
Q4	Transistor	1	2N2222A	80131	04713
Q5	Same as Q3				
R1	Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W	4	RCR07G392JS	81349	01121
R2	Resistor, Fixed, Composition: 120 kΩ, 5%, 1/4 W	2	RCR07G124JS	81349	01121
R3	Resistor, Fixed, Composition: 33 kΩ, 5%, 1/4 W	2	RCR07G333JS	81349	01121
R4	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4W	3	RCR07G222JS	81349	01121
R5	Resistor, Fixed, Composition: 39 kΩ, 5%, 1/4 W	2	RCR07G393JS	81349	01121
R6	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	2	RCR07G100JS	81349	01121
R7	Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W	5	RCR07G271JS	81349	01121
R8	Resistor, Variable, Film: 5 kΩ, 10%, 1/2 W	1	62PAR5K	73138	

REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R9	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R10	Same as R7				
R11	Same as R1				
R12	Same as R2				
R13	Resistor, Fixed, Composition: 680 kΩ, 5%, 1/4 W	2	RCR07G684JS	81349	01121
R14	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	4	RCR07G473JS	81349	01121
R15	Same as R5				
R16	Same as R6				
R17	Same as R7				
R18	Same as R4				
R19	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	3	RCR07G220JS	81349	01121
R20	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	2	RCR07G682JS	81349	01121
R21	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	6	RCR07G103JS	81349	01121
R22	Same as R21				
R23	Same as R20				
R24	Resistor, Fixed, Composition: 1.0 kΩ, 5% 1/4 W	4	RCR07G102JS	81349	01121
R25	Same as R24				
R26	Resistor, Fixed, Composition: 15 kΩ, 5%, 1/4 W	3	RCR07G153JS	81349	01121
R27	Same as R1				
R28	Same as R1				
R29	Same as R14				
R30	Same as R4				
R31	Resistor, Fixed, Composition: 330 kΩ, 5%, 1/4 W	1	RCR07G334JS	81349	01121
R32	Same as R14				
R33	Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W	1	RCR07G123JS	81349	01121
R34	Resistor, Fixed, Composition: 1 MΩ, 5%, 1/4 W	2	RCR07G105JS	81349	01121
R35	Same as R34				
R36	Resistor, Variable, Trimmer: 25 kΩ, 10%, 1/2 W	1	62PAR25K	73138	
R37	Same as R19				
R38	Not Used				
R39	Same as R14				
R40	Not Used				
R41	Same as R21				
R42	Same as R26				
R43	Resistor, Fixed, Composition: 100 Ω, 5% 1/4 W	2	RCR07G101JS	81349	01121
R44	Same as R13				

REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R45	Same as R26				
R46	Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W	2	RCR07G223JS	81349	01121
R47	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	1	RCR07G472JS	81349	01121
R48	Resistor, Fixed, Composition: 82 kΩ, 5%, 1/4 W	1	RCR07G823JS	81349	01121
R49	Same as R24				
R50	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	1	RCR07G122JS	81349	01121
R51	Same as R21				
R52	Resistor, Fixed, Composition: 3.3 MΩ, 5%, 1/4 W	1	RCR07G335JS	81349	01121
R53	Same as R3				
R54	Resistor, Fixed, Film: 18.2 kΩ, 1%, 1/10 W	1	RN55C1822F	81349	75042
R55	Resistor, Fixed, Film: 82.5 kΩ, 1%, 1/10 W	1	RN55C8252F	81349	75042
R56	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	2	RN55C1003F	81349	75042
R57	Same as R21				
R58	Same as R7				
R59	Same as R7				
R60	Same as R21				
R61	Same as R19				
R62	Same as R24				
R63	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R64	Same as R56				
R65	Same as R43				
R66	Resistor, Fixed, Composition: 68 kΩ, 5%, 1/4 W	1	RCR07G683JS	81349	01121
R67	Same as R46				
T1	Transformer	1	LL010	07388	
U1	Integrated Circuit	1	MC1496P	04713	
U2	Integrated Circuit	2	MC3403P	04713	
U3	Same as U2				

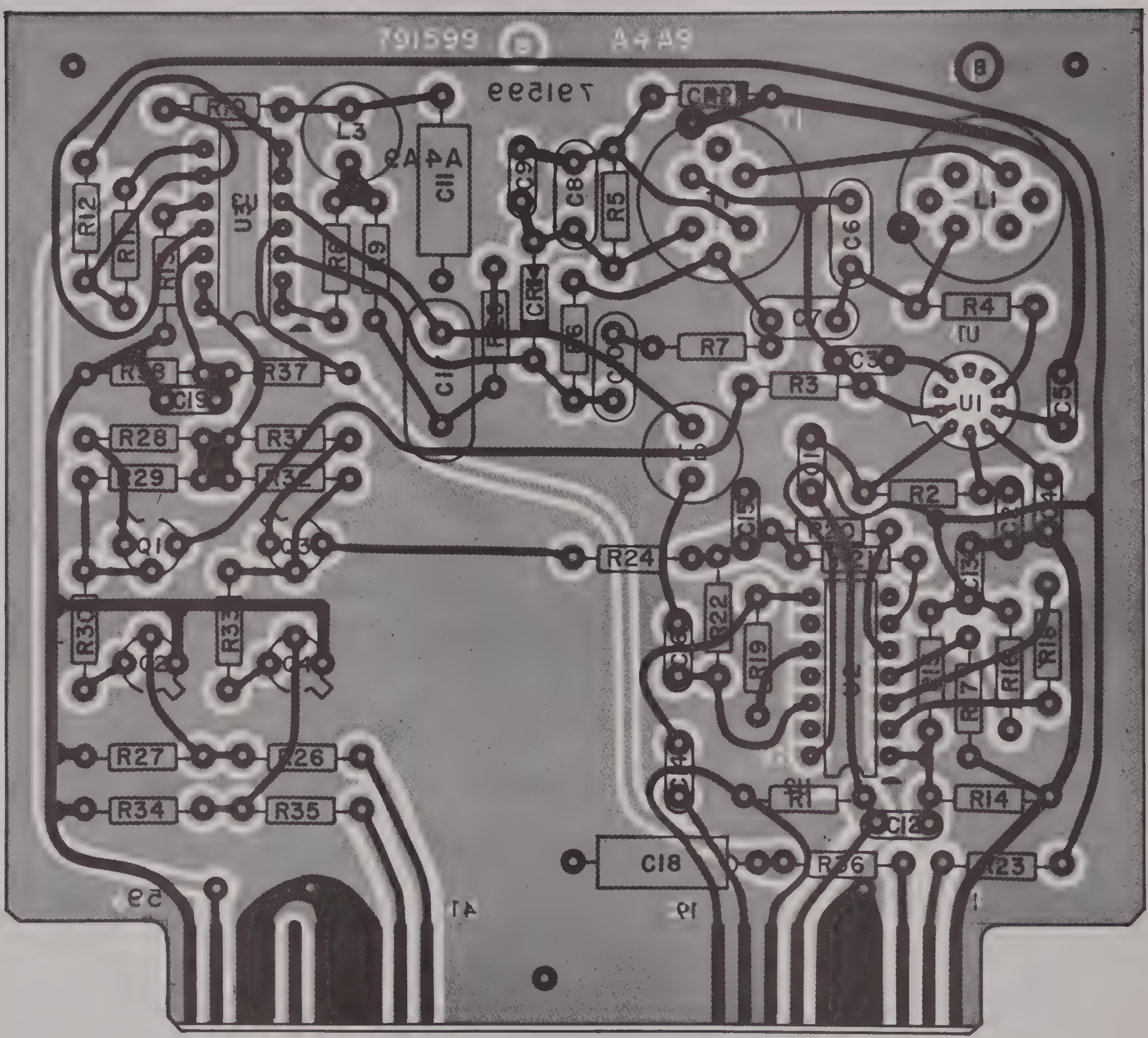

791599
A4A9
L3
C11
C9
C8
R5
T1
L1
R12
R10
U3
R9
R19
C6
R4
C7
R7
R3
C3
U1
C5
R38
R37
C19
R28
R29
Q1
Q3
L2
R2
R24
R20
R22
R19
R30
Q2
R33
Q4
R27
R26
R34
R35
R1
R14
C12
C18
R36
R23

Figure 5-19. Type 791599 FM, CW & SSB Detector (A4A9), Location of Components

5.5.4.9 Type 791599 FM, CW & SSB Detector REF DESIG PREFIX A4A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 60 V	10	34452-1	14632	
C2 Thru C5	Same as C1				
C6	Capacitor, Mica, Dipped: 470 pF, 2%, 500 V	1	DM15-471G	72136	
C7	Capacitor, Mica, Dipped: 330 pF, 2%, 500 V	2	CM05FD331G03	81349	72136
C8	Capacitor, Mica, Dipped: 390 pF, 2%, 500 V	1	CM05FD391G03	81349	72136
C9	Capacitor, Ceramic, Disc: 150 pF, 5%, 50 V	1	1U150RJ	93958	
C10	Same as C7				
C11	Capacitor, Plastic, Tubular: 0.015 μF, 5%, 100 V	1	663UW153-5-1W	84411	
C12 Thru C16	Same as C1				
C17	Capacitor, Mica, Dipped: 3300 pF, 2%, 500 V	1	CM06FD332G03	81349	72136
C18	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	1	CS13BE156K	81349	72136
C19	Capacitor, Electrolytic, Tantalum: 4.7 μF, 20%, 35 V	1	196D475X0035JE3	56289	
CR1	Diode	2	1N4449	80131	93332
CR2	Same as CR1				
L1	Coil, Variable	1	30312-258	14632	
L2	Coil, Fixed: 47 mH	2	553-3635-57	71279	
L3	Same as L2				
Q1	Transistor	2	2N2907/JAN	81350	04713
Q2	Transistor	2	2N2222A	80131	04713
Q3	Same as Q1				
Q4	Same as Q2				
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	4	RCR07G103JS	81349	01121
R2	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	3	RCR07G102JS	81349	01121
R3	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R4	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	3	RCR07G470JS	81349	01121
R5	Resistor, Fixed, Composition: 68 kΩ 5%, 1/4 W	3	RCR07G683JS	81349	01121
R6	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	3	RCR07G473JS	81349	01121
R7	Resistor, Fixed, Composition: 56 kΩ, 5%, 1/4 W	2	RCR07G563JS	81349	01121
R8	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/4 W	2	RCR07G472JS	81349	01121
R9	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	1	RCR07G222JS	81349	01121
R10	Resistor, Fixed, Composition: 560 kΩ, 5%, 1/4 W	1	RCR07G564JS	81349	01121
R11	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	1	RCR07G474JS	81349	01121
R12	Resistor, Fixed, Composition: 22 kΩ, 5% 1/4 W	3	RCR07G223JS	81349	01121

REF DESIG PREFIX A4A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R13	Same as R12				
R14	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	4	RCR07G682JS	81349	01121
R15	Same as R1				
R16	Same as R1				
R17	Same as R14				
R18	Same as R2				
R19	Same as R2				
R20	Same as R12				
R21	Resistor, Fixed, Composition: 3.9 kΩ, 5%, 1/4 W	2	RCR07G392JS	81349	01121
R22	Same as R21				
R23	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	2	RCR07G101JS	81349	01121
R24	Resistor, Fixed, Composition: 150 Ω 5%, 1/4 W	1	RCR07G151JS	81349	01121
R25	Same as R7				
R26	Same as R5				
R27	Same as R6				
R28	Same as R4				
R29	Resistor, Fixed, Composition: 82 kΩ, 5%, 1/4 W	2	RCR07G823JS	81349	01121
R30	Same as R14				
R31	Same as R4				
R32	Same as R29				
R33	Same as R14				
R34	Same as R6				
R35	Same as R5				
R36	Same as R23				
R37	Same as R8				
R38	Same as R1				
T1	Transformer	1	30312-257	14632	
U1	Integrated Circuit	1	CA3012	02735	
U2	Integrated Circuit	1	MC1496P	04713	
U3	Integrated Circuit	1	MC3403P	04713	

5.5.4.10 Type 7459 Audio Amplifier REF DESIG PREFIX A4A10

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	6	34452-1	14632	
C2	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	2	33475-1	14632	
C3	Same as C1				
C4	Capacitor, Electrolytic, Tantalum: 4.7 μF, 10%, 35 V	2	CS13BF475K	81349	56289
C5	Not Used				
C6	Same as C1				
C7	Same as C1				
C8	Same as C2				
C9	Same as C1				
C10	Same as C4				
C11	Not Used				
C12	Capacitor, Electrolytic, Tantalum: 15 μF, 10%, 20 V	2	CS13BE156K	81349	56289
C13	Same as C12				
C14	Same as C1				
C15	Not Used				
C16	Not Used				
C17	Capacitor, Ceramic, Disc: 5000 pF, 20%, 500 V	1	SM5000PFM	91418	
C18	Capacitor, Electrolytic, Tantalum: 47 μF, 10%, 35 V	3	CS13BF476K	81349	56289
C19	Same as C18				
C20	Same as C18				
CR1	Diode	1	1N4449	80131	93332
CR2	Diode	2	1N198A	80131	93332
CR3	Same as CR2				
Q1	Transistor	1	U1899E	15818	
R1	Resistor, Fixed, Composition: 22 kΩ, 5%, 1/4 W	3	RCR07G223JS	81349	01121
R2	Resistor, Fixed, Composition: 330 kΩ, 5%, 1/4 W	1	RCR07G334JS	81349	01121
R3	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	2	RCR07G473JS	81349	01121
R4	Same as R3				
R5	Resistor, Fixed, Composition: 2.2 MΩ, 5%, 1/4 W	1	RCR07G225JS	81349	01121
R6	Resistor, Fixed, Film: 2.0 kΩ, 1%, 1/10 W	2	RN55C2001F	81349	01121
R7	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	3	RCR07G104JS	81349	01121
R8	Same as R7				
R9	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	4	RN55C1003F	81349	75042
R10	Same as R9				
R11	Same as R1				
R12	Resistor, Fixed, Composition: 12 kΩ, 5%, 1/4 W	1	RCR07G123JS	81349	01121

REF DESIG PREFIX A4A10

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R13	Resistor, Fixed, Composition: 27 kΩ, 5%, 1/4 W	1	RCR07G273JS	81349	01121
R14	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	2	RCR07G682JS	81349	01121
R15	Not Used				
R16	Not Used				
R17	Resistor, Fixed, Composition: 18 kΩ, 5%, 1/4 W	1	RCR07G183JS	81349	01121
R18	Same as R7				
R19	Same as R6				
R20	Same as R9				
R21	Same as R9				
R22	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	2	RCR07G101JS	81349	01121
R23	Same as R1				
R24	Same as R14				
R25	Not Used				
R26	Not Used				
R27	Same as R22				
R28	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
RA1	Heat Radiator	1	24566-1	14632	
T1	Transformer	1	LL010	07388	
U1	Integrated Circuit	1	MC3403P	04713	
U2	Integrated Circuit	1	LM378N	27014	

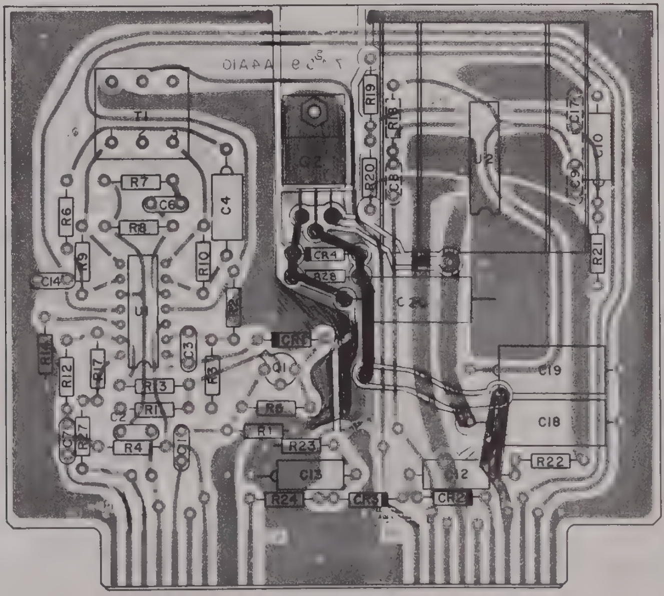

T1
R7
C6
C4
R6
R8
R9
R10
C14
U1
R2
C3
CR1
R14
R12
R17
R13
R3
Q1
R11
C2
R5
C7
R27
R4
C1
R1
R23
C13
R24
CR3
Q2
R19
R18
R20
C8
CR4
R28
C20
U2
C17
C10
C9
R21
C19
C18
C12
R22
CR2

Figure 5-20. Type 7459 Audio Amplifier (A4A10), Location of Components

5.5.5 TYPE 791570 SYNTHESIZER MOTHERBOARD REF DESIG PREFIX A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	1st & 3rd LO, Timebase	1	791630	14632	
A2	2nd LO Synthesizer	1	791601	14632	
A3	BFO, Synthesizer	1	791576	14632	
C1	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	58	34453-1	14632	
C2 Thru C58	Same as C1				
C59	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	4	34452-1	14632	
C60	Same as C59				
C61	Same as C59				
C62	Same as C59				
J1	Faston, Tabs	3	62073-1	00779	
J2	Same as J1				
J3	Same as J1				
L1	Ferrite, Choke	4	VK200-10-3B	02114	
L2 Thru L4	Same as L1				
P1	Cable, Flat, Flex	1	5107-902-1	00779	
P2	Cable, Flat, Flex	1	507-902-2	00779	
U1	Integrated Circuit	2	7805UC	07263	
U2	Same as U1				
XA1	Contact Strip	20	PE7-14046	00779	
XA2	Same as XA1				
XA3	Same as XA1				

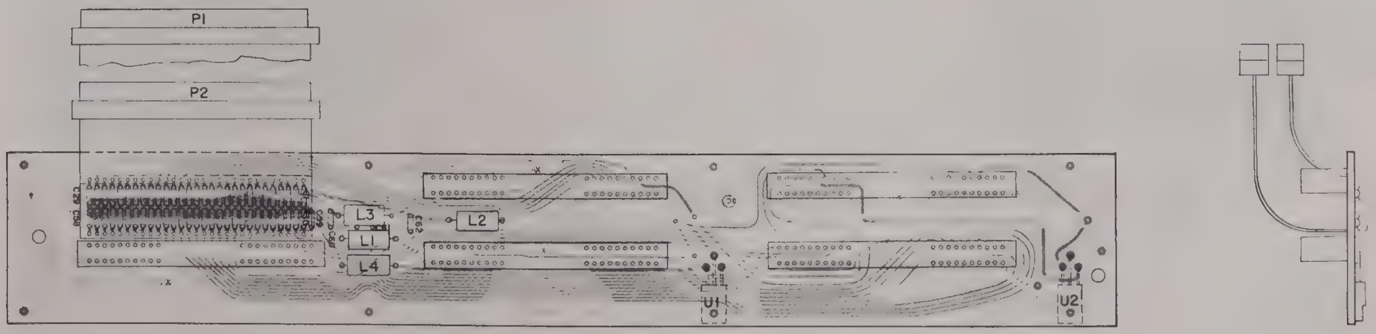


Figure 5-21. Type 791570 Synthesizer Motherboard (A5), Location of Components

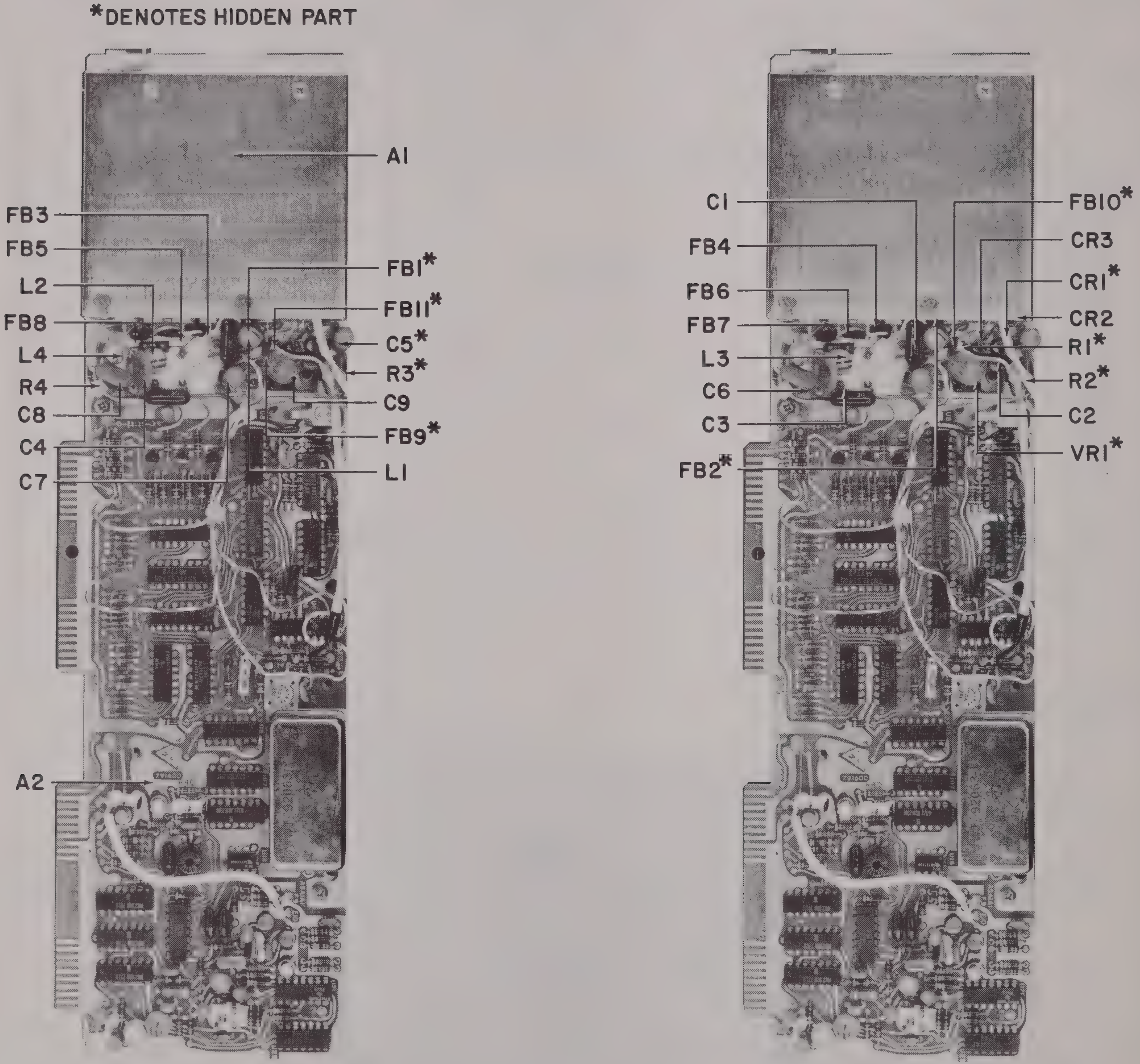

*DENOTES HIDDEN PART
A1
FB3
FB5
L2
FB8
L4
R4
C8
C4
C7
FB1*
FB11*
C5*
R3*
C9
FB9*
L1
A2
C1
FB4
FB6
FB7
L3
C6
C3
FB2*
FB10*
CR3
CR1*
CR2
R1*
R2*
C2
VR1*

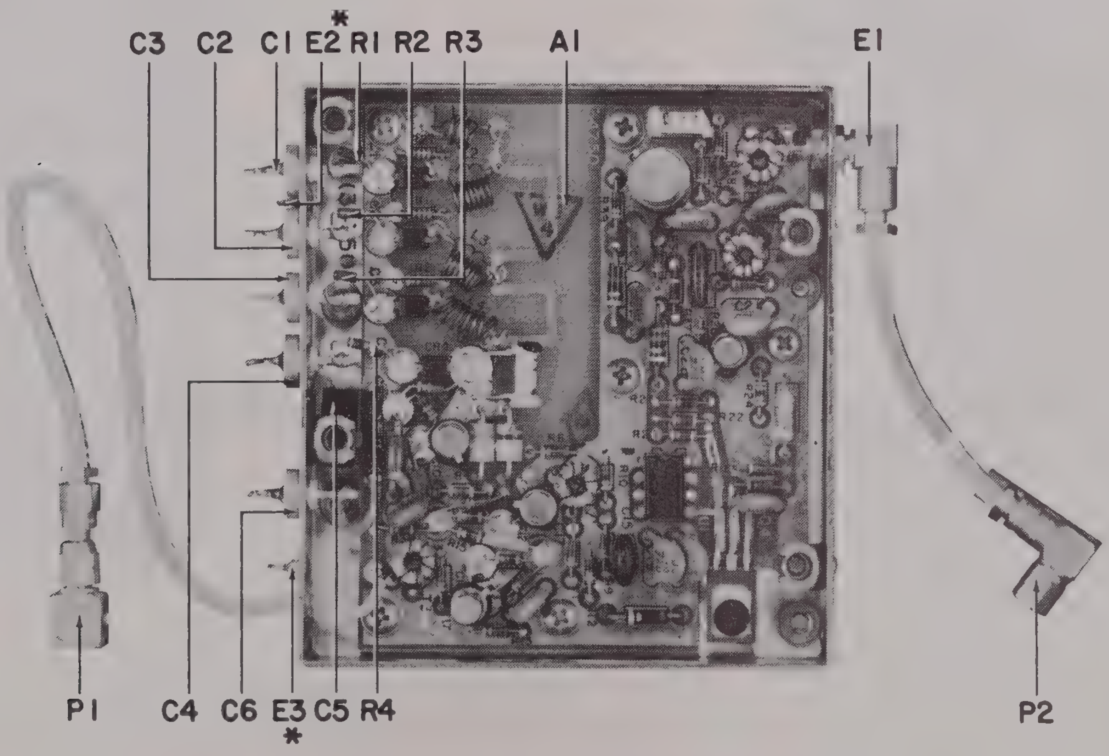
Figure 5-22. Type 791630 1st & 3rd LO Synthesizer/Timebase (A5A1), Location of Components

5.5.5.1 Type 791630 1st & 3rd LO Synthesizer/Timebase REF DESIG PREFIX A5A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	1st LO, Voltage Control Oscillator	1	791629	14632	
A2	1st & 3rd LO Synthesizer	1	791600	14632	
C1	Capacitor, Mica, Dipped: 1600 pF, 2%, 500 V	2	CM06FD162G03	81349	72136
C2	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 100 V	2	8131M100-651-474M	72982	
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.05 μF, 20%, 100 V	2	29C212A7	56289	
C5	Capacitor, Electrolytic, Tantalum: 47 μF, 20%, 20 V	2	196D476X0020P34	56289	
C6	Same as C2				
C7	Same as C5				
C8	Same as C4				
C9	Capacitor, Electrolytic, Tantalum: 100 μF, 20%, 20 V	1	196D107X0020TE4	56289	
CR1	Diode	3	1N4449	80131	93332
CR2	Same as CR1				
CR3	Same as CR1				
FB1	Ferrite Bead	17	56-590-65-4A	02114	
FB2 Thru FB17	Same as FB1				
L1	Coil, Fixed: 10 mH	2	553-3635-49	71279	
L2	Coil, Fixed: 0.82 μH	1	1537-10	99800	
L3	Same as L1				
L4	Coil, Fixed: 4.7 mH	1	553-3635-45	71279	
R1	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R2	Resistor, Fixed, Composition: 6.2 kΩ, 5%, 1/4 W	1	RCR07G622JS	81349	01121
R3	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	01121
R4	Same as R3				
VR1	Voltage Regulator: 12 V	1	MC7912CP	04713	

5.5.5.1.1 Type 791629 1st LO, VCO Assembly REF DESIG PREFIX A5A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	1st LO Voltage Control Oscillator	1	34750	14632	
C1	Capacitor, Ceramic, Feedthru: 1000 pF, GMV 500 V	5	54-794-009-102W	33095	
C2 Thru C4	Same as C1				
C5	Capacitor, Electrolytic, Tantalum: 68 μF, 20%, 15 V	1	183DR686X0015F	56289	
C6	Same as C1				
E1	Connector, Terminal	1	144/188	19505	
E2	Terminal, Forked	2	140-1019-02-01	71279	
E3	Same as E2				
P1	Connector, Plug: SMC Series	1	UG1465/U	80058	
P2	Connector, Plug: SMC Series	1	UG1466/U	80058	
R1	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/8 W	3	RCR05G122JS	81349	01121
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Composition: 47 Ω, 5%, 1/8 W	1	RCR05G470JS	81349	01121



*DENOTES HIDDEN PART

Figure 5-23. Type 791629 1st LO, VCO Assembly (A5A1A1), Location of Components

5.5.5.1.1.1 Part 34750 1st LO, VCO REF DESIG PREFIX A5A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 200 pF, 50%, 500 V	10	32-257578-40	91984	
C2 Thru C4	Same as C1				
C5	Capacitor, Ceramic, Disc: 3 pF±0.25 pF, 500 V	1	603C0G3R0C	91984	
C6	Capacitor, Ceramic, Tubular: 5.1 pF±0.25 pF, 500 V	1	301-000C0H0-519C	72982	
C7	Capacitor, Composition, Tubular: 2.7 pF, 10%, 500 V	1	QC(2.7PF,K)	95121	
C8	Same as C1				
C9	Capacitor, Composition, Tubular: 1.0 pF, 10%, 500 V	1	QC(1.0PF,K)	95121	
C10	Same as C1				
C11	Capacitor: 0.1 μF, 20%, 50 V	1	34475-1	14632	
C12	Same as C1				
C13	Same as C1				
C14	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	7	B470PFM	72982	
C15	Capacitor, Mica, Dipped: 100 pF, 2%, 500 V	1	CM04FD101G03	81349	72136
C16	Same as C1				
C17	Same as C1				
C18	Capacitor, Electrolytic, Tantalum: 2.2 μF, 10%, 20 V	1	CS13BE225K	81349	56289
C19 Thru C20	Same as C14				
C21	Same as C14				
C22	Not Used				
C23	Same as C14				
C24	Not Used				
C25	Same as C14				
C26	Capacitor, Ceramic, Disc: 5000 pF, 20%, 100 V	2	C023B101E502M	56289	
C27	Same as C26				
C28	Capacitor, Ceramic, Tubular: 5.1 pF±0.5 pF, 500 V	1	301-000C0H0-519D	72982	
C29	Same as C14				
CR1	Diode	3	MPN3401	04713	
CR2	Same as CR1				
CR3	Same as CR1				
CR4	Diode, Varicap	1	BB105B	25088	
E1	Terminal, Forked	11	140-1941-02-01	71279	
E2 Thru E11	Same as E1				

REF DESIG PREFIX A5A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
FB1	Ferrite Bead	1	56-590-65-4A	02114	
L1	Coil, Air	1	24592-1	14632	
L2	Coil, Air	3	24593-1	14632	
L3	Same as L2				
L4	Same as L2				
L5	Coil, Fixed: 0.56 μH	1	202-11	99848	
Q1	Transistor	1	U310	17856	
Q2	Transistor	2	2N257	07263	
Q3	Same as Q2				
Q4	Transistor	1	2N4918	80131	04713
Q5	Transistor	1	2N3251	80131	04713
Q6	Not Used				
Q7	Transistor	1	2N5109	80131	02735
R1	Resistor, Fixed, Composition: 33 kΩ, 5%, 1/8 W	3	RCR05G333JS	81349	01121
R2	Same as R1				
R3	Resistor, Fixed, Composition: 22 kΩ, 5%, 1/8 W	1	RCR05G223JS	81349	01121
R4	Resistor, Fixed, Composition: 470 Ω, 5%, 1/8 W	4	RCR05G471JS	81349	01121
R5	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/8 W	1	RCR05G104JS	81349	01121
R6	Resistor, Fixed, Composition: 8.2 kΩ, 5%, 1/8 W	2	RCR05G822JS	81349	01121
R7	Resistor, Fixed, Composition: 5.6 kΩ, 5%, 1/8 W	2	RCR05G562JS	81349	01121
R8	Resistor, Fixed, Composition: 300 Ω, 5%, 1/8 W	3	RCR05G301JS	81349	01121
R9	Resistor, Fixed, Composition: 220 Ω, 5%, 1/8 W	1	RCR05G221JS	81349	01121
R10	Resistor, Fixed, Composition: 68 Ω, 5%, 1/8 W	2	RCR05G680JS	81349	01121
R11	Resistor, Fixed, Composition: 180 Ω, 5%, 1/8 W	1	RCR05G181JS	81349	01121
R12	Same as R10				
R13	Same as R6				
R14	Same as R7				
R15	Resistor, Fixed, Composition: 47 Ω, 5%, 1/8 W	4	RCR05G470JS	81349	01121
R16	Same as R8				
R17	Resistor, Fixed, Composition: 150 Ω, 5%, 1/8 W	1	RCR05G151JS	81349	01121
R18	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/8 W	2	RCR05G102JS	81349	01121
R19	Same as R8				
R20	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	1	RCR07G100JS	81349	01121
R21	Same as R4				
R22	Same as R4				
R23	Resistor, Fixed, Composition: 10 Ω, 5%, 1/8 W	1	RCR05G100JS	81349	01121

REF DESIG PREFIX A5A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R24	Resistor, Fixed, Composition: 33 Ω, 5%, 1/8 W	1	RCR05G330JS	81349	01121
R25	Resistor, Fixed, Composition: 270 Ω, 5%, 1/8 W	1	RCR05G271JS	81349	01121
R26	Same as R15				
R27	Same as R1				
R28	Same as R15				
R29	Resistor, Fixed, Composition; 22 Ω, 5%, 1/4 W	1	RCR07G220JS	81349	01121
R30	Same as R15				
R31 Thru R33	Not Used				
R34	Resistor, Fixed, Composition: 15 Ω, 5%, 1/8 W	1	RCR05G150JS	81349	01121
R35	Resistor, Fixed, Composition: 560 Ω, 5%, 1/8 W	1	RCR05G561JS	81349	01121
R36	Same as R18				
R37	Same as R4				
R38	Not Used				
R39	Not Used				
R40	Resistor, Fixed, Composition: 51 Ω, 5%, 1/4 W	1	RCR07G510JS	81349	01121
T1	Part of P.C, Board				
T2	Transformer, Toroidal	2	21278-23	14632	
T3	Same as T2				
T4	Transformer, Toroidal	2	21278-27	14632	
T5	Not Used				
T6	Same as T4				
U1	Integrated Circuit	1	MC1697P	04713	

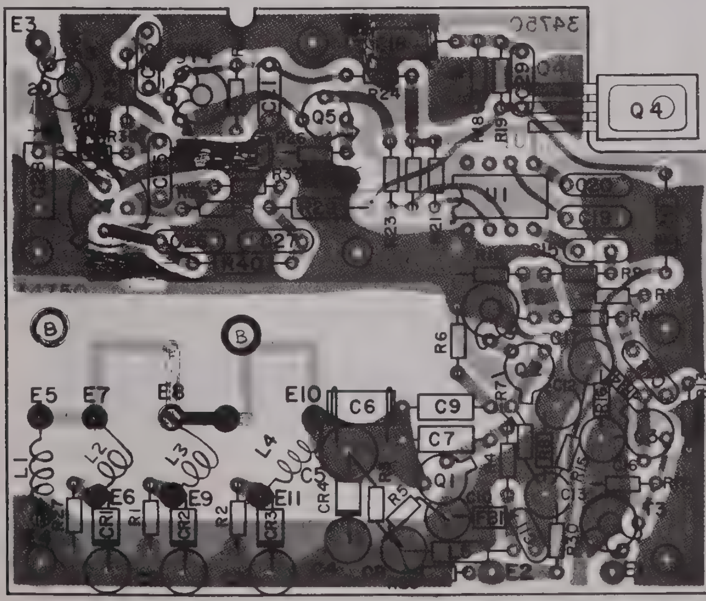
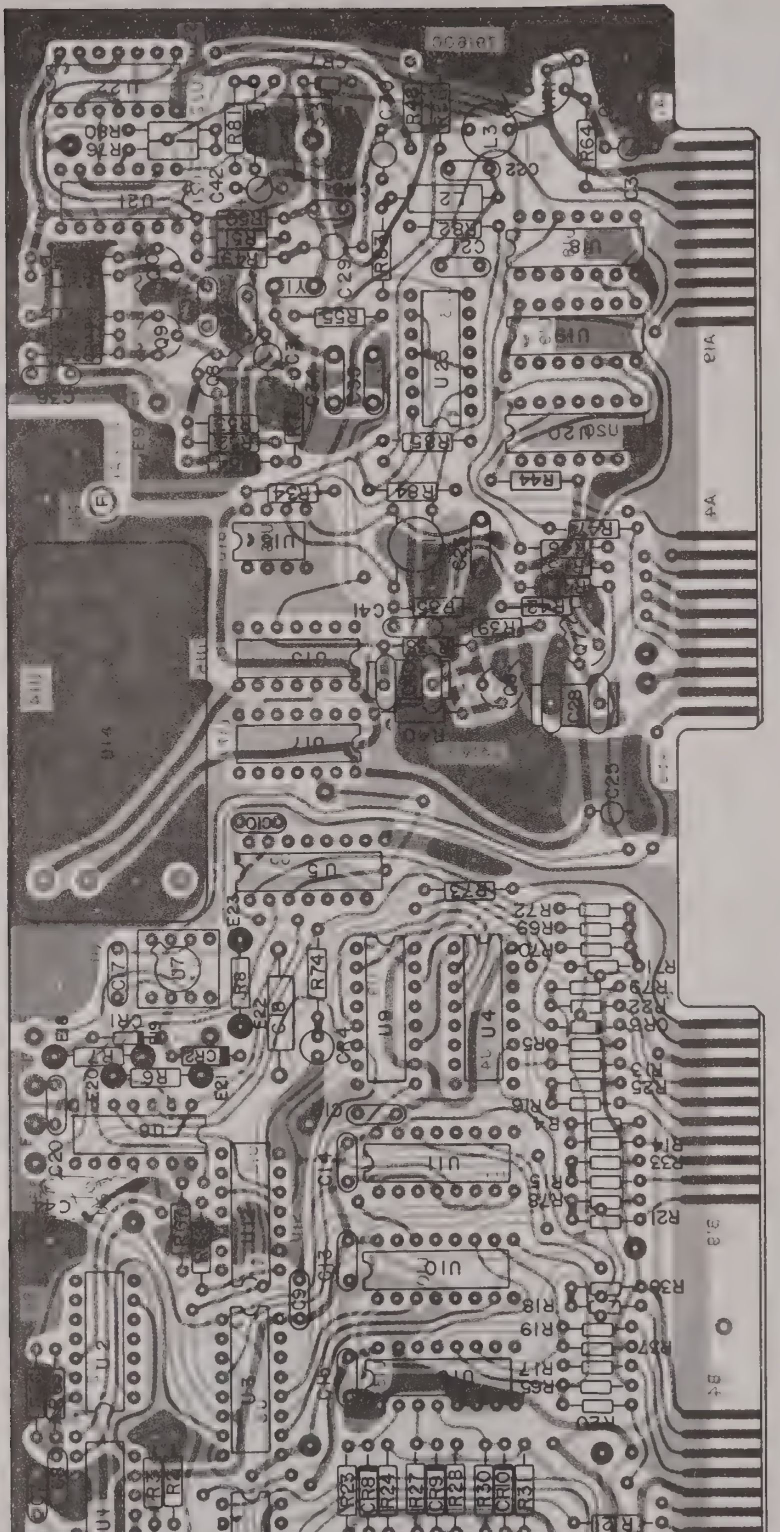

E3
34750
Q5
R24
Q4
R18
R19
R26
R3
R23
R21
U1
C20
C19
C27
R40
B
B
R6
R7
E5
E7
E8
E10
C6
C9
C7
L1
L2
L3
L4
C5
E6
E9
E11
CR1
R1
CR2
R2
CR3
CR4
R5
Q1
FB1
C13
R15
R30
E2

Figure 5-24. Type 34750 1st LO VCO (A5A1A1A1), Location of Components


R81
R55
R85
R84
R34
R44
R82
L2
L3
R64
C41
R39
R40
C25
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U5
R73
R72
R69
R70
R74
U9
U4
U11
U10
R78
R21
R33
R18
R19
R17
R65
R20
R37
R23
CR8
R24
R27
CR9
R28
R30
CR10
R31
R26
R29
R32
Q2
Q3
Q4
R9
R66
R12
R6
R7
CR2
E23
E22
C18
U2
U3
U1
U6
C11
R3
R4

Figure 5-25. Type 791600 1st and 3rd LO Synthesizer (A5A1A2), Location of Components

5.5.5.1.2 Type 791600 1st & 3rd LO Synthesizer REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Mica, Dipped: 47 pF, 2%, 500 V	2	CM04ED470G03	81349	72136
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	2	B470PFM	91418	
C4	Not Used				
C5	Not Used				
C6	Not Used				
C7	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 200 V	13	8131A200Z5U103M	72982	
C8 Thru C15	Same as C7				
C16	Capacitor, Electrolytic, Tantalum: 22 μF, 20%, 15 V	7	196D226X0015KE3	56289	
C17	Same as C3				
C18	Capacitor, Fixed, Plastic: 4700 pF, 10%, 100 V	1	WMF1D47	14655	
C19	Not Used				
C20	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
C21	Same as C7				
C22	Capacitor, Ceramic, Disc: 1000 pF, GMV 500 V	1	SM1000PFP	91418	
C23	Capacitor, Mica, Dipped: 820 pF, 5%, 300 V	1	DM15-821J	72136	
C24	Not Used				
C25	Same as C16				
C26	Same as C16				
C27	Not Used				
C28	Capacitor, Ceramic, Tubular: 47 pF, 5%, 500 V	2	308-000C0G0-470J	72982	
C29	Capacitor, Electrolytic, Tantalum: 100 μF, 20%, 10 V	1	196D107X0010LA3	56289	
C30	Capacitor, Electrolytic, Tantalum: 2.2 μF, 20%, 35 V	1	196D225X0035JE3	56289	
C31	Same as C16				
C32	Same as C20				
C33	Capacitor, Variable, Ceramic: 2-8 pF, 350 V	1	538-006A2-8	72982	
C34	Capacitor, Mica, Dipped: 220 pF, 2%, 500 V	2	CM05FD221G03	81349	72136
C35	Same as C34				
C36	Same as C7				
C37	Same as C7				
C38	Same as C16				
C39	Same as C16				
C40	Same as C28				
C41	Same as C7				
C42	Same as C16				

REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C43	Capacitor, Mica, Dipped: 18 pF, 5%, 500 V	1	CM04CD180J03	81349	72136
C44	Capacitor, Mica, Dipped: 330 pF, 2%, 500 V	1	CM05FD331G03	81349	72136
CR1	Diode	3	5082-2800	28480	
CR2	Same as CR1				
CR3	Same as CR1				
CR4	Diode	1	5082-4684	28480	
CR5	Not Used				
CR6	Not Used				
CR7	Diode, Varicap	1	BB105B	25088	
CR8	Diode Zener: 15 V	3	1N965B	80131	04713
CR9	Same as CR8				
CR10	Same as CR8				
E1	Terminal, Forked	24	140-1941-02-01	71279	
E2 Thru E24	Same as E1				
J1	Connector, Receptacle: SMC Series	1	50-053-0000	98291	
L1	Coil, Fixed: 0.24 μH	1	200-11	99848	
L2	Coil, Fixed: 8.2 μH	1	1537-34	99800	
L3	Coil, Fixed: 100 μH	1	553-3635-25	71279	
Q1	Not Used				
Q2	Transistor	3	2N4401	80131	04713
Q3	Same as Q2				
Q4	Same as Q2				
Q5	Not Used				
Q6	Transistor	4	2N709A	80131	02735
Q7	Transistor	1	2N2222A	80131	04713
Q8 Thru Q10	Same as Q6				
R1	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	6	RCR07G101JS	81349	01121
R2	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	6	RCR07G471JS	81349	01121
R3	Same as R2				
R4	Resistor, Fixed, Composition: 82 kΩ, 5%, 1/8 W	4	RCR05G823JS	81349	01121
R5	Same as R4				
R6*	Resistor, Fixed, Composition: 5.6 kΩ, 5%, 1/4 W * Nominal value, final value factory selected	4	RCR07G562JS	81349	01121

REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R7*	Same as R6				
R8*	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	1	RCR07G104JS	81349	01121
R9 Thru R12	Same as R1				
R13	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	10	RCR05G101JS	81349	01121
R14 Thru R22	Same as R13				
R23	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	5	RCR07G222JS	81349	01121
R24	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	5	RCR07G103JS	81349	01121
R25	Same as R4				
R26	Resistor, Fixed, Composition: 20 kΩ, 5%, 1/4 W	3	RCR07G203JS	81349	01121
R27	Same as R23				
R28	Same as R24				
R29	Same as R26				
R30	Same as R23				
R31	Same as R24				
R32	Same as R26				
R33	Same as R4				
R34	Same as R6				
R35	Same as R6				
R36	Resistor, Fixed, Composition: 27 kΩ, 5%, 1/8 W	5	RCR05G273JS	81349	01121
R37	Same as R36				
R38	Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W	1	RCR07G272JS	81349	01121
R39	Same as R23				
R40	Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W	5	RCR07G271JS	81349	01121
R41	Resistor, Fixed, Composition: 4.3 kΩ, 5%, 1/4 W	1	RCR07G432JS	81349	01121
R42	Same as R23				
R43	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	15	RCR07G102JS	81349	01121
R44	Same as R2				
R45	Same as R36				
R46	Same as R40				
R47	Same as R40				
R48	Same as R43				
R49	Resistor, Fixed, Composition: 330 Ω, 5%, 1/4 W	1	RCR07G331JS	81349	01121
	* Nominal value, final value factory selected				

REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R50	Same as R24				
R51	Same as R43				
R52	Same as R43				
R53	Same as R24				
R54	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	3	RCR07G220JS	81349	01121
R55	Resistor, Fixed, Composition: 27 Ω, 5%, 1/4 W	1	RCR07G270JS	81349	01121
R56	Same as 40				
R57	Same as R54				
R58	Resistor, Fixed, Composition: 150 Ω, 5%, 1/4 W	2	RCR07G151JS	81349	01121
R59	Same as R58				
R60	Not Used				
R61	Same as R43				
R62	Not Used				
R63	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R64	Resistor, Fixed, Composition: 3.3 Ω, 5%, 1/4 W	1	RCR07G3R3JS	81349	01121
R65 Thru R68	Same as R43				
R69	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/8 W	4	RCR05G102JS	81349	01121
R70 Thru R72	Same as R69				
R73	Same as R24				
R74	Same as R2				
R75	Same as R43				
R76	Same as R43				
R77	Same as R54				
R78	Same as R36				
R79	Same as R36				
R80	Same as R43				
R81	Same as R43				
R82	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R83	Same as R1				
R84	Same as R43				
R85	Same as R43				
R86	Same as R40				
RA1	Heatsink	1	2225B	13103	

REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
T1	Inductor, Transformer Assembly	1	22295-50	14632	
U1	Integrated Circuit	1	MC12013L	04713	
U2	Integrated Circuit	2	SN74S196N	01295	
U3	Integrated Circuit	1	MC12014L	04713	
U4	Integrated Circuit	1	SN74185AN	01295	
U5	Integrated Circuit	2	MC4044P	04713	
U6	Integrated Circuit	1	SN74LS00N	01295	
U7	Integrated Circuit	1	CA6741T	02735	
U8	Integrated Circuit	2	SN74LS190N	01295	
U9	Integrated Circuit	1	MC74417P	04713	
U10	Same as U8				
U11	Same as U8				
U12	Integrated Circuit	1	SN74S74N	01295	
U13	Integrated Circuit	1	SN74184N	01295	
U14	TCXO	1	92063-1	14632	
U15	Integrated Circuit	5	SN74LS196N	01295	
U16	Integrated Circuit	1	SN75140N		
U17 Thru U20	Same as U15				
U21	Integrated Circuit	1	SN74LS74N	01295	
U22	Same as U5				
U23	Integrated Circuit	1	SN74125	01295	
VR1	Voltage Regulator	1	78M05HC	07263	
Y1	Crystal, Quartz	1	CR64U11.155MHz	80058	74306

5.5.5.2 Type 791601 2nd LO Synthesizer

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	3	34452-1	14632	
C2	Same as C1				
C3	Capacitor, Electrolytic, Tantalum: 47 µF, 20%, 20 V	3	196D476X0020PE4	56289	
C4	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	9	196D226X0010JE3	56289	
C5	Capacitor, Electrolytic, Tantalum: 1 µF, 20%, 10 V	2	196D105X0035HE3	56289	
C6	Capacitor, Ceramic, Disc: 2200 pF, 10%, 200 V	1	CK06BX222K	81349	56289
C7	Same as C4				
C8	Same as C3				
C9	Capacitor, Mica, Dipped: 12 pF, 5%, 500 V	1	CM05CD120J03	81349	72136
C10	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C11	Capacitor, Ceramic, Disc: 0.01 µF, 20%, 50 V	16	34453-1	14632	
C12	Same as C11				
C13	Same as C10				
C14	Same as C4				
C15	Same as C4				
C16	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	3	B470PFM	91418	
C17	Capacitor, Electrolytic, Tantalum: 150 µF, 20%, 6 V	1	196D157X0006PE4	56289	
C18	Same as C5				
C19 Thru C21	Same as C11				
C22	Capacitor, Ceramic, Tubular: 7.5 pF±0.5 pF, 500 V	1	301-000C0H0-759D	72982	
C23	Capacitor, Mica, Dipped: 220 pF, 2%, 500 V	1	CM05FD221G03	81349	72136
C24	Same as C11				
C25	Same as C3				
C26 Thru C28	Same as C4				
C29	Capacitor, Plastic, Tubular: 0.022 µF, 5%, 100 V	1	663UW223-5-1W	84411	
C30	Capacitor, Fixed, Plastic: 4700 pF, 10%, 100 V	1	WMF1D47	14655	
C31	Not Used				
C32	Same as C4				
C33	Same as C16				
C34	Same as C16				
C35	Same as C11				
C36	Capacitor, Ceramic, Disc: 1000 pF, GMV, 500 V	8	SM1000 PFP	91418	
C37	Same as C4				

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C38	Same as C36				
C39	Same as C36				
C40	Same as C11				
C41	Same as C36				
C42 Thru C48	Same as C11				
C49	Capacitor, Ceramic, Tubular: 12 pF, 5%, 500 V	2	301-000C0G0-120J	72982	
C50	Capacitor, Ceramic, Tubular: 47 pF, 5%, 500 V	6	308-000C0G0-470J	72982	
C51	Capacitor, Variable, Air: 0.4-2.5 pF, 500 V	2	7283	91293	
C52	Capacitor, Ceramic, Tubular: 6.8 pF±0.25 pF, 500 V	2	301-000C0H0-689C	72982	
C53	Same as C50				
C54	Same as C50				
C55	Same as C36				
C56	Capacitor, Ceramic, Tubular: 8.2 pF±0.5 pF, 500 V	1	301-000C0H0-829D	72982	
C57	Capacitor, Ceramic, Tubular: 6.2 pF± 0.5 pF, N470	2	301-000T2J629D	72982	
C58	Same as C11				
C59	Capacitor, Ceramic, Tubular: 22 pF, 5%, 500 V	1	301-000C0G0-220J	72982	
C60	Same as C50				
C61	Same as C51				
C62	Same as C52				
C63	Same as C50				
C64	Same as C50				
C65	Same as C36				
C66	Capacitor, Ceramic, Tubular: 5.6 pF±0.25 pF, 500 V	1	301-000C0H0-569C	72982	
C67	Same as C57				
C68	Capacitor, Mica, Dipped: 150 pF, 2%, 500 V	1	CM05FD151G03	81349	72136
C69	Capacitor, Ceramic, Tubular: 4.7 pF±0.1 pF, 500 V	1	301-000C0H0-479B	72982	
C70	Capacitor, Ceramic, Tubular: 2.0 pF±0.25 pF, 500 V	1	301-000C0K0-209C	72982	
C71	Same as C49				
C72	Capacitor, Mica, Dipped: 1000 pF, 5%, 100 V	1	DM15-102J	72136	
C73	Same as C36				
C74	Same as C1				
C75	Capacitor, Ceramic, Disc: 100 pF, 2%, 500 V	1	CM04FD101G03	81349	
CR1	Diode	2	5082-4684	28480	
CR2	Diode	1	1N4446	80131	93332
CR3	Diode, Varicap	3	BB109-YELLOW	25088	

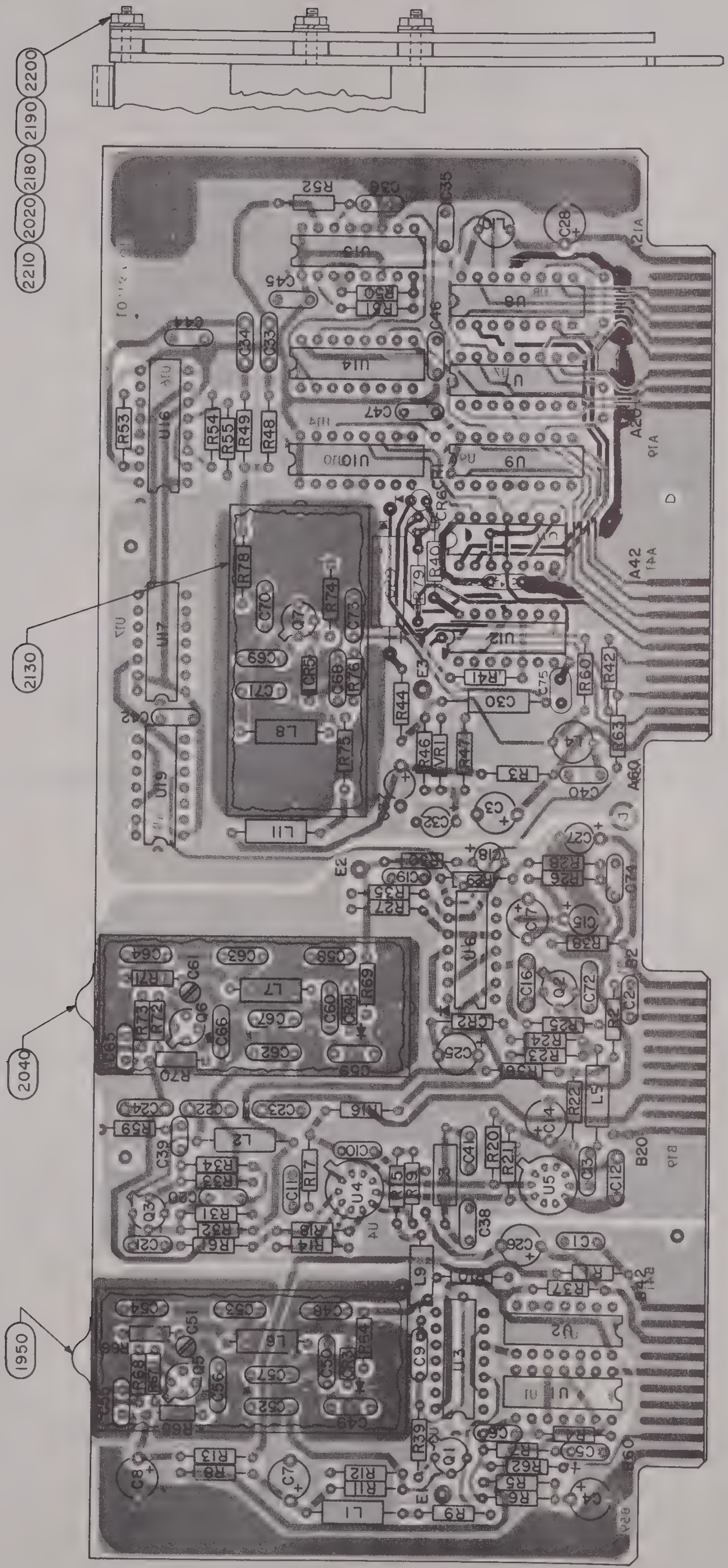

2210
2020
2180
2190
2200
2130
2040
1950

Figure 5-26. Type 791601 2nd LO (A5A2), Location of Components

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR4	Same as CR3				
CR5	Same as CR3				
CR6	Same as CR1				
E1	Terminal, Forked	3	140-1941-02-01	71279	
E2	Same as E1				
E3	Same as E1				
L1	Coil, Fixed, Molded: 0.47 μH	1	1537-06	99800	
L2	Coil, Fixed, Molded: 1.5 μH	1	1537-16	99800	
L3	Coil, Fixed, Molded: 680 μH	2	2500-20	99800	
L4	Coil, Fixed: 22 mH	1	553-3635-53	71279	
L5	Same as L3				
L6	Coil, Fixed: 0.82 μH	2	1537-10		
L7	Same as L6				
L8	Inductor	1	21210-183	14632	
L9	Coil, Fixed: 2.2 μH	1	1025-28		
L10	Coil, Fixed: 10 μH	1	553-3635-13	71279	
L11	Coil, Fixed: 100 μH	1	1537-76	99800	
Q1	Transistor	2	2N709A	80131	02735
Q2	Same as Q1				
Q3	Transistor	1	841001-1	14632	
Q4	Not Used				
Q5	Transistor	2	2N2857	80131	02735
Q6	Same as Q5				
Q7	Transistor	1	U310	17856	
R1	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	6	RCR07G220JS	81349	01121
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Composition: 1.8 kΩ, 5%, 1/4 W	1	RCR07G182JS	81349	01121
R5	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	7	RCR07G100JS	81349	01121
R6	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	12	RCR07G102JS	81349	01121
R7	Resistor, Fixed, Composition: 1.2 kΩ, 5%, 1/4 W	1	RCR07G122JS	81349	01121
R8	Same as R5				
R9	Same as R6				
R10	Resistor, Fixed, Composition: 5.6 Ω, 5%, 1/4 W	1	RCR07G5R6JS	81349	01121
R11	Resistor, Fixed, Composition: 5.1 kΩ, 5%, 1/4 W	1	RCR07G512JS	81349	01121
R12	Same as R6				

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R13	Same as R5				
R14	Same as R6				
R15	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	8	RCR07G470JS	81349	01121
R16 Thru R18	Same as R15				
R19	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	01121
R20	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	2	RCR07G222JS	81349	01121
R21	Same as R20				
R22	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R23	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 W	1	RCR07G682JS	81349	01121
R24	Same as R6				
R25	Same as R6				
R26	Same as R5				
R27	Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W	2	RCR07G272JS	81349	01121
R28	Same as R5				
R29	Same as R6				
R30	Resistor, Fixed, Composition: 270 Ω, 5%, 1/4 W	1	RCR07G271JS	81349	01121
R31	Resistor, Fixed, Composition: 1.0 MΩ, 5%, 1/4 W	1	RCR07G105JS	81349	01121
R32	Resistor, Fixed, Composition: 820 kΩ, 5%, 1/4 W	1	RCR07G824JS	81349	01121
R33	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	1	RCR07G104JS	81349	01121
R34	Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W	1	RCR07G561JS	81349	01121
R35	Same as R27				
R36	Same as R5				
R37	Resistor, Fixed, Composition: 4.7 Ω, 5%, 1/4 W	1	RCR07G4R7JS	81349	01121
R38	Same as R5				
R39	Resistor, Fixed, Composition: 56 Ω, 5%, 1/4 W	1	RCR07G560JS	81349	01121
R40	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	5	RCR07G471JS	81349	01121
R41	Same as R6				
R42	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	7	RCR07G103JS	81349	01121
R43	Not Used				
R44	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	1	RCR07G473JS	81349	01121
R45	Not Used				
R46	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W	1	RCR07G152JS	81349	01121
R47	Resistor, Fixed, Composition: 750 Ω, 5%, 1/4 W	1	RCR07G751JS	81349	01121
R48	Same as R15				

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R49	Same as R15				
R50	Same as R40				
R51	Same as R40				
R52	Same as R6				
R53	Same as R6				
R54	Same as R40				
R55	Same as R40				
R56	Not Used				
R57	Not Used				
R58	Not Used				
R59	Same as R15				
R60	Same as R6				
R61	Same as R6				
R62	Same as R42				
R63	Same as R42				
R64	Same as R42				
R65	Resistor, Fixed, Film: 18.2 kΩ, 1%, 1/10 W	4	RN55C1822F	81349	75042
R66	Same as R65				
R67	Same as R1				
R68	Resistor, Fixed, Film: 3.92 kΩ, 1%, 1/10 W	2	RN55C3921F	81349	75042
R69	Same as R42				
R70	Same as R65				
R71	Same as R65				
R72	Same as R1				
R73	Same as R68				
R74	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R75	Same as R1				
R76	Same as R42				
R77	Not Used				
R78	Same as R15				
R79	Same as R42				
U1	Integrated Circuit	3	MC4044P	04713	
U2	Integrated Circuit	1	868281	14632	
U3	Integrated Circuit	1	SN74S74N	01295	
U4	Integrated Circuit	1	796HC	07263	
U5	Integrated Circuit	1	N5733K	18324	

REF DESIG PREFIX A5A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U6	Same as U1				
U7	Integrated Circuit	1	SN74LS190N	01295	
U8	Integrated Circuit	3	SN74LS191N	01295	
U9	Same as U8				
U10	Same as U8				
U11	Integrated Circuit	1	SN74LS00N	01295	
U12	Same as U1				
U13	Not Used				
U14	Integrated Circuit	1	SN74LS168N	01295	
U15	Integrated Circuit	2	MC12013P	04713	
U16	Same as U5				
U17	Integrated Circuit	1	SN74LS196N	01295	
U18	Not Used				
U19	Integrated Circuit	1	868292	14632	
VR1	Diode, Zener: 8.2 V	1	1N756A	80131	04713

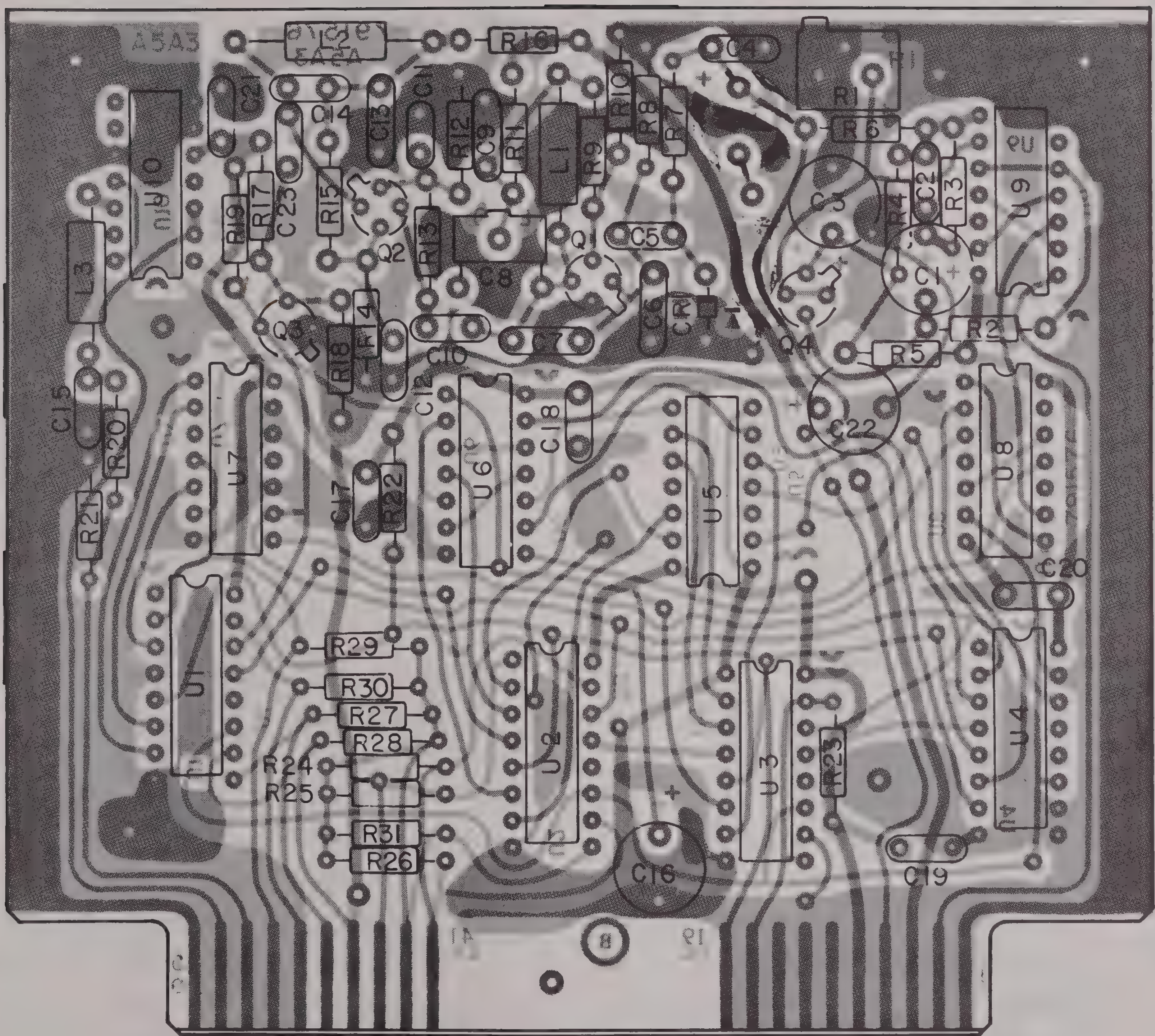

A5A3
L2
R16
C4
R1
C21
C14
C13
C11
R12
C9
R11
L1
R9
R10
R8
R7
R6
U10
R19
R17
C23
R15
Q2
R13
C8
Q1
C5
C3
R4
C2
R3
U9
L3
C1
Q3
R18
R14
C10
C7
C6
CR1
Q4
R5
R2
C12
C15
R20
U7
C18
U6
U5
C22
U8
R21
C17
R22
C20
U1
R29
R30
R27
R28
R24
R25
R31
R26
U2
U3
R23
U4
C16
C19

Figure 5-27. Type 791576 BFO Synthesizer (A5A3), Location of Components

5.5.5.3 Type 791576 BFO Synthesizer

REF DESIG PREFIX A5A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Electrolytic, Tantalum: 3.3 μF, 20%, 35 V	1	196D335X0035JE3	56289	
C2	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	1	34475-1	14632	
C3	Capacitor, Electrolytic, Tantalum: 47 μF, 20%, 20 V	3	196D476X0020PE4	56289	
C4	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	1	34452-1	14632	
C5	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	10	34453-1	14632	
C6	Capacitor, Ceramic, Tubular: 33 pF, 5%, 500 V	1	308-000C0G0-330J	72982	
C7	Capacitor, Ceramic, Tubular: 47 pF, 5%, 500 V	1	308-000C0G0-470J	72982	
C8	Capacitor, Variable, Ceramic: 2-8 pF, 350 V	1	538-006A2-8	72982	
C9	Same as C5				
C10	Capacitor, Mica, Dipped: 10 pF±0.5 pF, 500 V	2	CM04CD100D03	81349	72136
C11	Capacitor, Ceramic, Disc: 1000 pF, GMV, 500 V	2	SM 1000 PFP	91418	
C12	Same as C11				
C13	Same as C5				
C14	Same as C10				
C15	Same as C5				
C16	Same as C3				
C17 Thru C21	Same as C5				
C22	Same as C3				
C23	Same as C5				
CR1	Diode, Varicap	1	BB109-YELLOW	25088	
L1	Coil, Fixed: 27 μH	1	1537-48	99800	
L2	Coil, Fixed, Mold: 330 μH	1	2500-04	99800	
L3	Coil, Fixed: 0.82 μH	1	1537-10	99800	
Q1	Transistor	1	2N2857	80131	02735
Q2	Transistor	1	841001-2	14632	
Q3	Transistor	1	2N709A	80131	02735
Q4	Transistor	1	3N128	80131	02735
R1	Resistor, Trim, Film: 500 Ω, 10%, 1/2 W	1	62PAR500	73138	
R2	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	15	RCR07G102JS	81349	01121
R3	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	3	RCR07G103JS	81349	01121
R4	Same as R2				
R5	Resistor, Fixed, Composition: 10 Ω, 5%, 1/4 W	3	RCR07G100JS	81349	01121
R6	Same as R2				
R7	Same as R3				

REF DESIG PREFIX A5A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R8	Resistor, Fixed, Film: 4.22 kΩ, 1%, 1/10 W	1	RN55C4221F	81349	75042
R9	Resistor, Fixed, Film: 17.8 kΩ, 1%, 1/10 W	2	RN55C1782F	81349	75042
R10	Same as R9				
R11	Same as R5				
R12	Resistor, Fixed, Composition: 560 Ω, 5%, 1/4 W	1	RCR07G561JS	81349	01121
R13	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	1	RCR07G104JS	81349	01121
R14	Resistor, Fixed, Composition: 1.0 MΩ, 5%, 1/4 W	1	RCR07G105JS	81349	01121
R15	Resistor, Fixed, Composition: 820 kΩ, 5%, 1/4 W	1	RCR07G824JS	81349	01121
R16	Same as R5				
R17	Same as R3				
R18	Same as R2				
R19	Same as R2				
R20	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R21	Resistor, Fixed, Composition: 62 Ω, 5%, 1/4 W	1	RCR07G620JS	81349	01121
R22 Thru R31	Same as R2				
U1	Integrated Circuit	4	SN74LS190N	01295	
U2 Thru U4	Same as U1				
U5	Integrated Circuit	2	SN7425N	01295	
U6	Integrated Circuit	1	SN74LS11N	01295	
U7	Same as U5				
U8	Integrated Circuit	1	867474	14632	
U9	Integrated Circuit	1	MC4044P	04713	
U10	Integrated Circuit	1	SN74LS90N	01295	

5.5.6 TYPE 791580 I/O MOTHERBOARD REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	Manual Tune Up, Down Count	1	791575-1	14632	
A2	Front Panel Inerconnect	1	791828	14632	
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	3	34452-1	14632	
C2	Same as C1				
C3	Same as C1				
J1	Post, Feedthru:	3	PE7-14045	00779	
J2	Same as J1				
J3	Same as J1				
J4	Faston Tabs	4	62073-1	00779	
J5	Same as J4				
J6	Same as J4				
J7	Same as J4				
XA1	Contract Strip	36	PE7 14046	00779	
XA2 Thru XA36	Same as XA1				

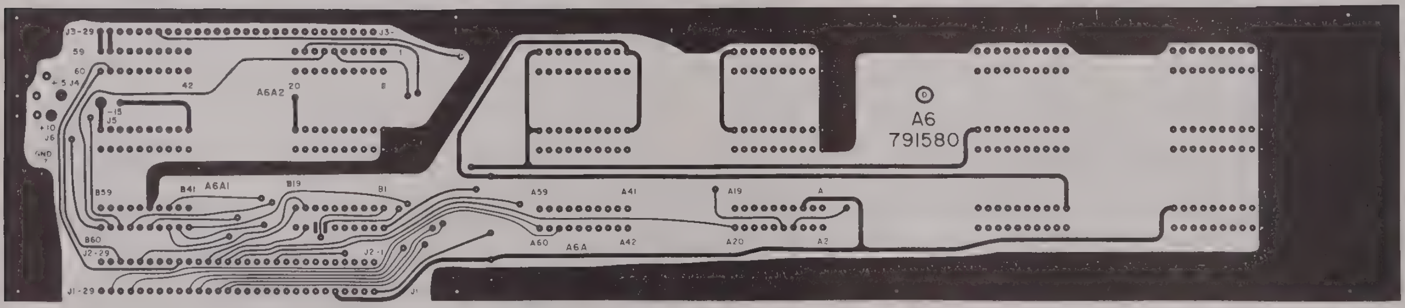

J3-29
J3-
59
60
1
42
A6A2
20
8
+5 J4
-15
J5
+10
J6
GND
A6
791580
B59
B41
A6A1
B19
B1
A59
A41
A19
A
B60
J2-29
J2-1
A60
A6A
A42
A20
A2
J1-29
J1

Figure 5-28. Type 791580 I/O Motherboard (A6), Location of Components

5.5.6.1 Type 791575-1 Manual Tuning Up/Down Counter REF DESIG PREFIX A6A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
BT1	Battery	1	1/3AA-SD1	19209	
C1	Capacitor, Electrolytic, Tantalum: 22 µF, 10%, 15 V	1	CS13BD226K	81349	56289
C2	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	1	B470PFM	91418	
C3	Capacitor, Ceramic, Disc: 0.01µF, 20%, 50 V	5	34453-1	14632	
C4 Thru C7	Same as C3				
CR1	Diode	1	5082-2900	28480	
J1	Connector	1	88139-1	00779	
J2	Connector Right Angle Header	3	87567-4	00779	
J3	Same as J2				
J4	Same as J2				
Q1	Transistor	1	2N2222A	80131	04713
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	7	RCR07G103JS	81349	01121
R2	Same as R1				
R3	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R4	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	3	RCR07G102JS	81349	01121
R5 Thru R8	Same as R1				
R9	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	1	RCR07G471JS	81349	01121
R10	Same as R1				
R11	Same as R4				
R12	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R13	Same as R4				
R14	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W		RCR07G474JS	81349	
U1	Integrated Circuit	1	MM74C14N	27014	
U2	Integrated Circuit	6	MC14510P	04713	
U3 Thru U7	Same as U2				
U8	Integrated Circuit	3	MC14081P	04713	
U9	Integrated Circuit	1	MC14027P	04713	
U10	Integrated Circuit	1	MC14070P	04713	
U11	Same as U8				
U12	Integrated Circuit	4	MC14512P	04713	
U13 Thru U15	Same as U12				

REF DESIG PREFIX A6A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U16	Integrated Circuit	1	MC14520BCP	04713	
U17	Integrated Circuit	1	MC14050BP	04713	
U18	Same as U8				

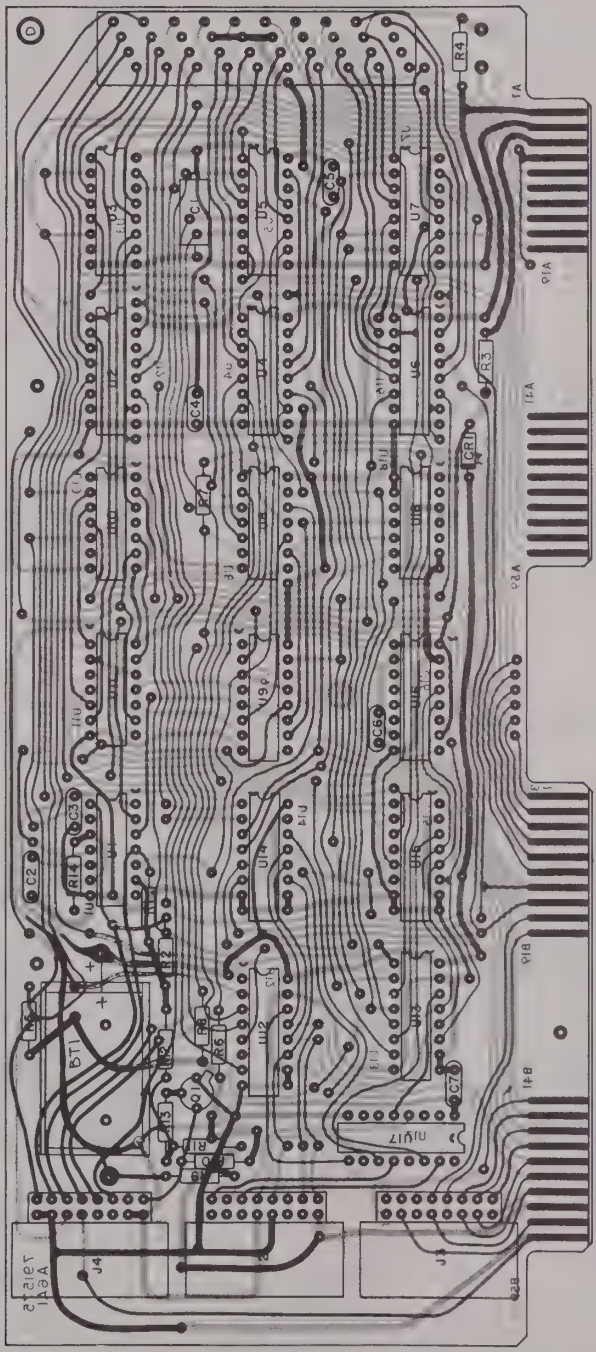

R4
J1
C1
C5
U3
U5
U7
A19
R3
A41
U2
U4
U6
C4
CR1
R7
U10
U8
U18
A59
U9
U11
U15
C6
C3
R14
C2
U1
U14
U16
R2
BT1
R5
R6
U12
U13
C7
U17
R13
Q1
R1
J4
J3
791575 1A6A1
B18
B48
B28

Figure 5-29. Type 791575-1 Manual Tuning Up/Down Counter (A6A1), Location of Components

5.5.6.2 Type 791591 Front Panel Interconnect

REF DESIG PREFIX A6A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	1	34452-1	14632	
CR1	Diode	10	1N995	80131	04713
CR2 Thru CR10	Same as CR1				
J1	Header	1	1-87567-6	00779	
Q1	Transistor	1	2N4037	80131	02735
R1	Resistor, Fixed, Composition: 620 Ω, 5%, 1/4 W	1	RCR07G621JS	81349	01121
R2	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R3	Resistor, Fixed, Composition: 2.7 Ω, 5%, 1/4 W	1	RCR07G2R7JS	81349	01121
R4	Resistor, Fixed, Composition: 1.0 mΩ, 5%, 1/4 W	1	RCR07G105JS	81349	01121
R5	Resistor, Fixed, Composition: 22 Ω, 5%, 1/2 W	1	RCR20G220JS	81349	01121
U1	Integrated Circuit	1	MC14053B	04713	

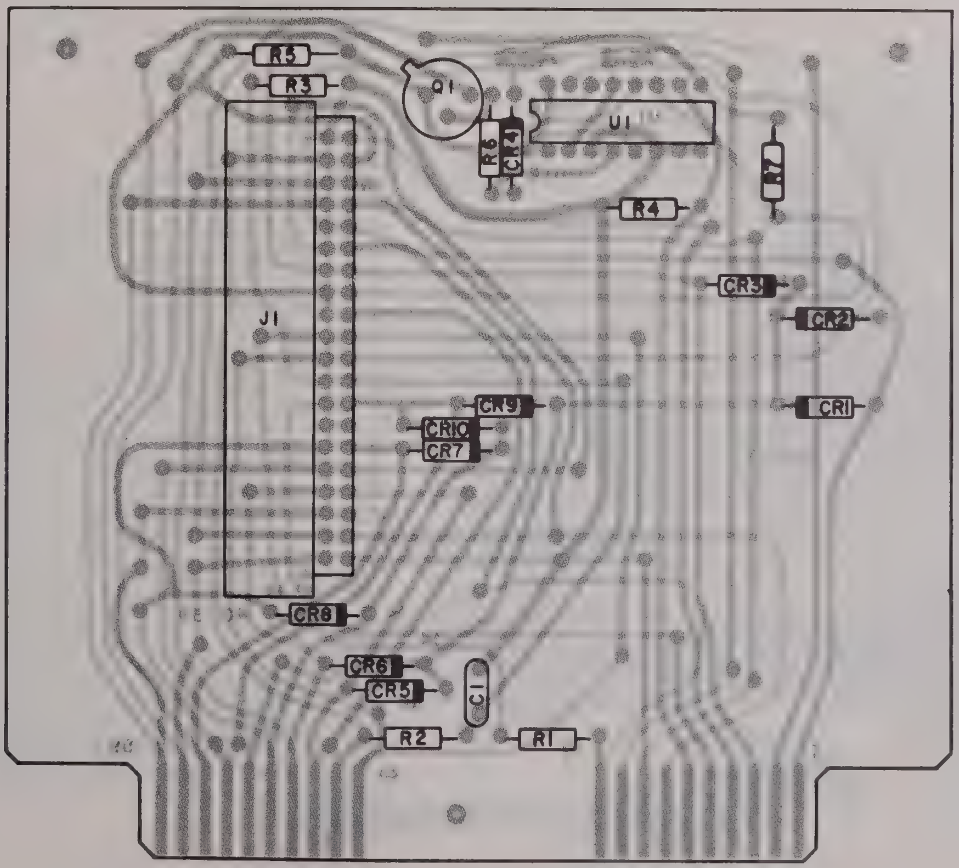


Figure 5-30. Type 791591 Front Panel Interconnect (A6A2), Location of Components

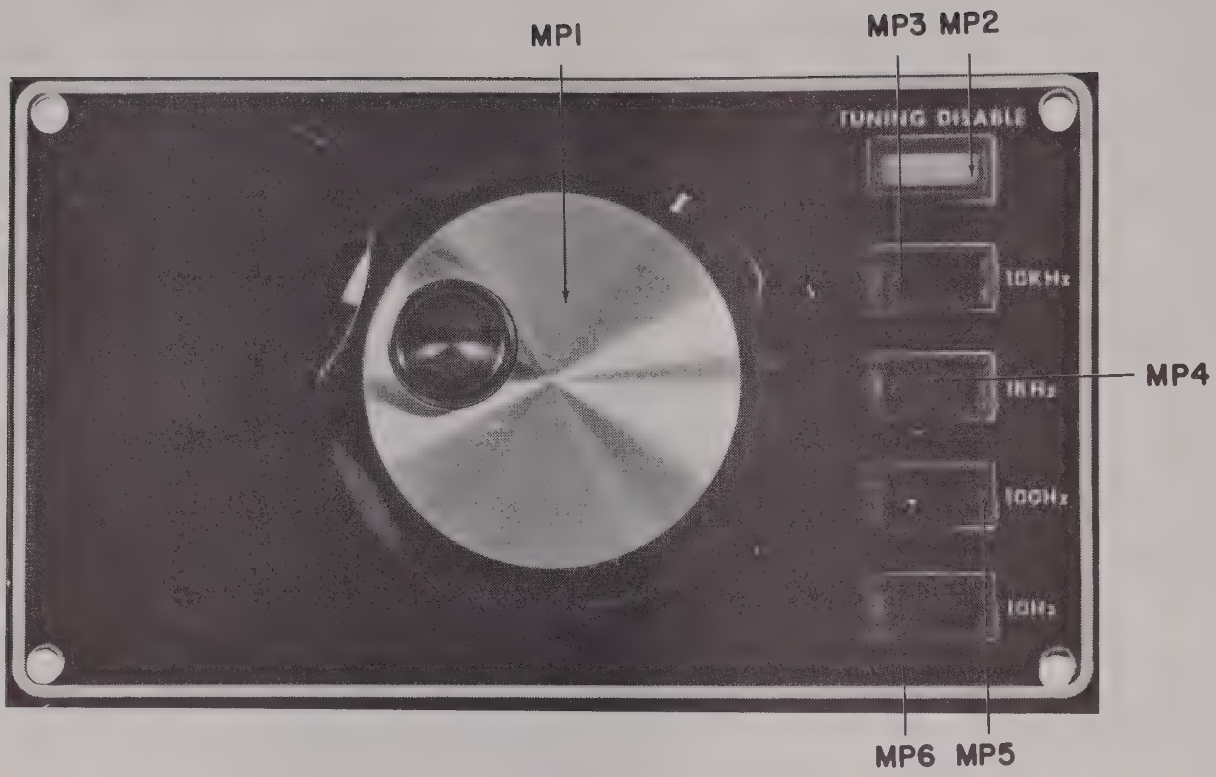

MP1
MP3
MP2
TUNING DISABLE
10KHz
1KHz
MP4
100Hz
10Hz
MP6
MP5

Figure 5-31. Type 791874-1 Manual Tuning Module (A7), Location of Components, Front View

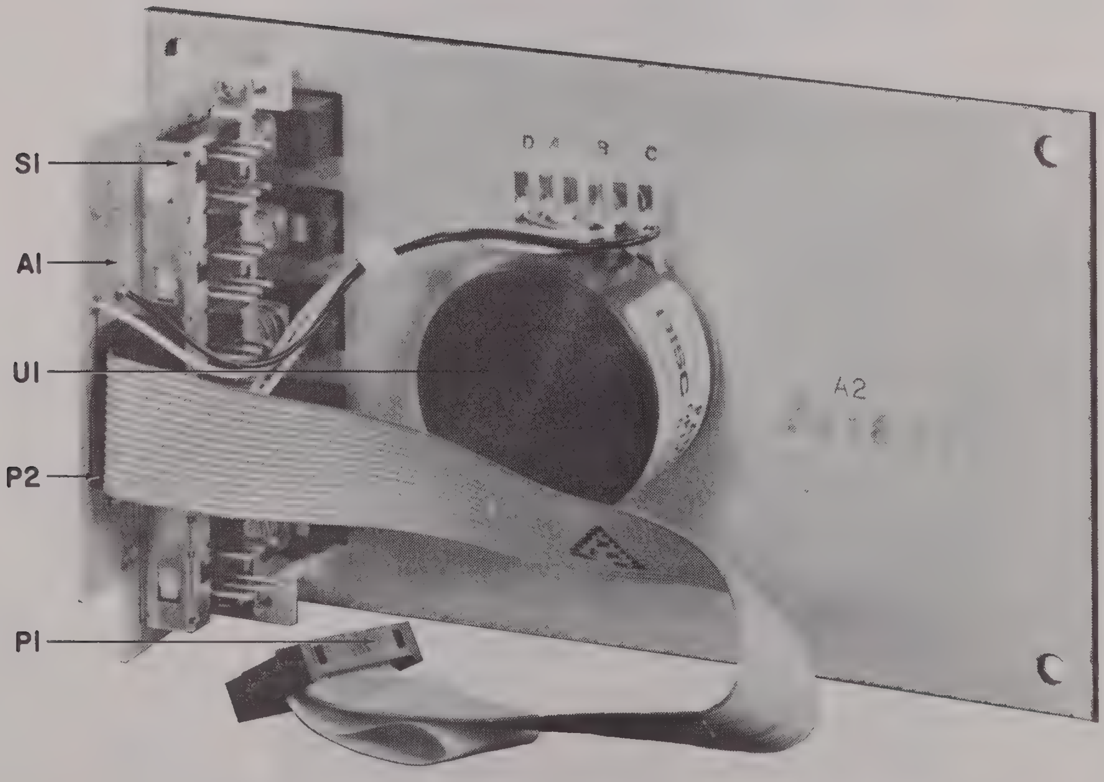

S1
A1
U1
P2
P1
A2

Figure 5-32. Type 791874-1 Manual Tuning Module (A7), Location of Components, Back View

5.5.7 TYPE 791874-1 MANUAL TUNING MODULE REF DESIG PREFIX A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	Tuning Resolution	1	791589	14632	
MP1	Knob Assembly	1	35005-1	14632	
MP2	Button: Black Shell with Green Indicator	5	FA101-BLKW/GRN	31918	
MP3 Thru MP6	Same as MP2				
U1	Encoder	1	34836-1	14632	

5.5.7.1 Type 791589 Tuning Resolution REF DESIG PREFIX A7A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
P1	Connector, Plug	1	88011-2	00779	
P2	Connector, Receptacle, Plug	1	JF3S1PACD	81312	
S1	Switch, Push Button	1	18488	14632	

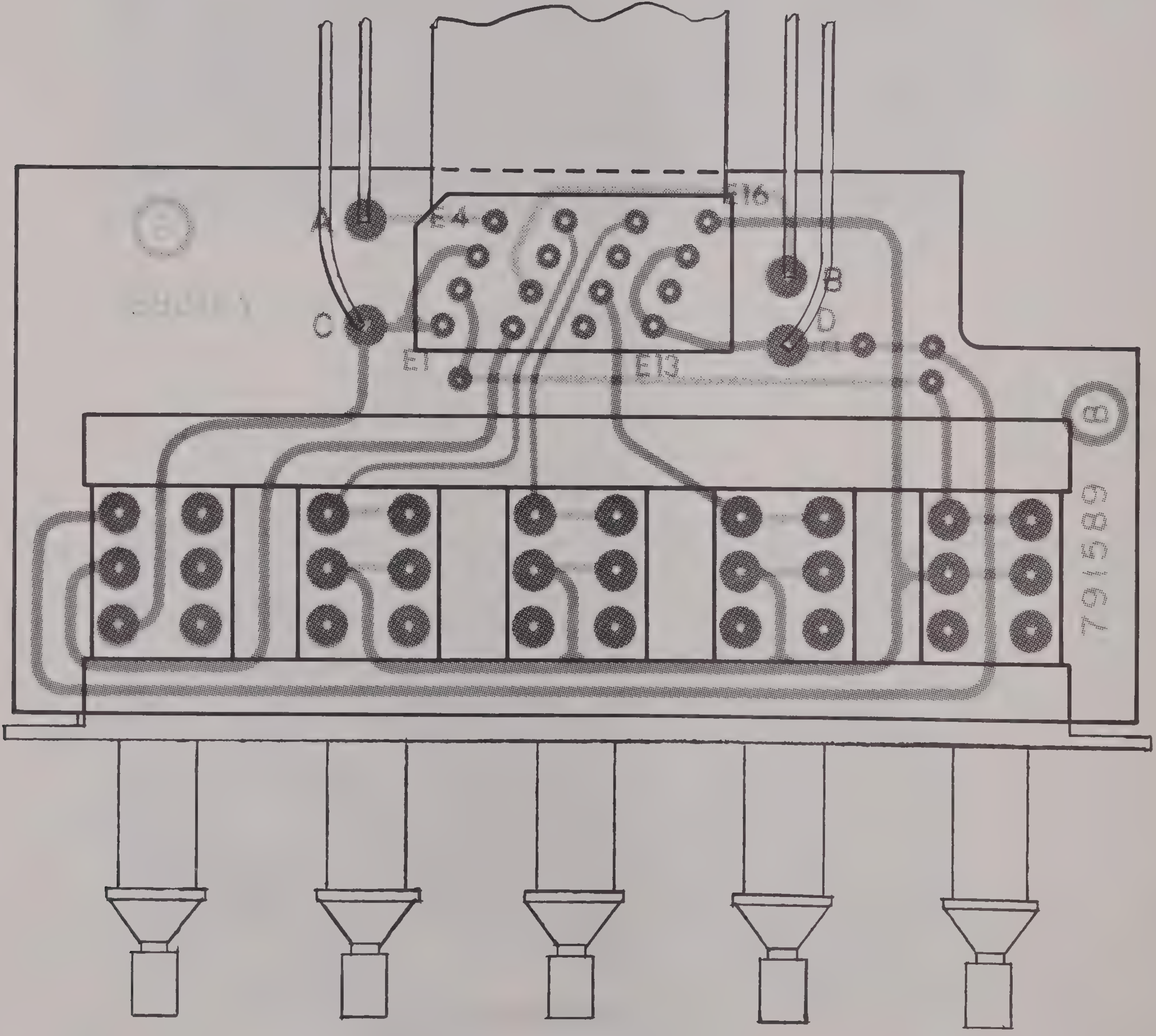


Figure 5-33. Type 791589 Tuning Resolution (A7A1), Location of Components

5.5.8 TYPE 791578 FREQUENCY DISPLAY

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	2	34453-1	14632	
C2	Same as C1				
CR1	Diode	1	5082-4190	28480	
P1	Connector	1	88011-2	00779	
Q1	Transistor	1	TIP 29	01295	
R1	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R2	Resistor, Trim, Film: 100 Ω, 10%, 3/4 W	1	89PR100	73138	
R3	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	1	RCR07G821JS	81349	01121
R4	Resistor, Fixed, Composition: 200 Ω, 5%, 1/4 W	1	RCR07G201JS	81349	01121
U1	Integrated Circuit	7	5082-7673	28480	
U2 Thru U7	Same as U1				
U8	Integrated Circuit	1	DS8857N	87014	
U9	Integrated Circuit	1	CD4028AE	02735	
U10	Integrated Circuit	1	DS8863N	87014	
XCR1	Receptacle Pin	2	3-116141-2	00779	
XCR2	Same as XCR1				
XU1	Socket, Integrated Circuit	7	583527-1	00779	
XU2 Thru XU7	Same as XU1				

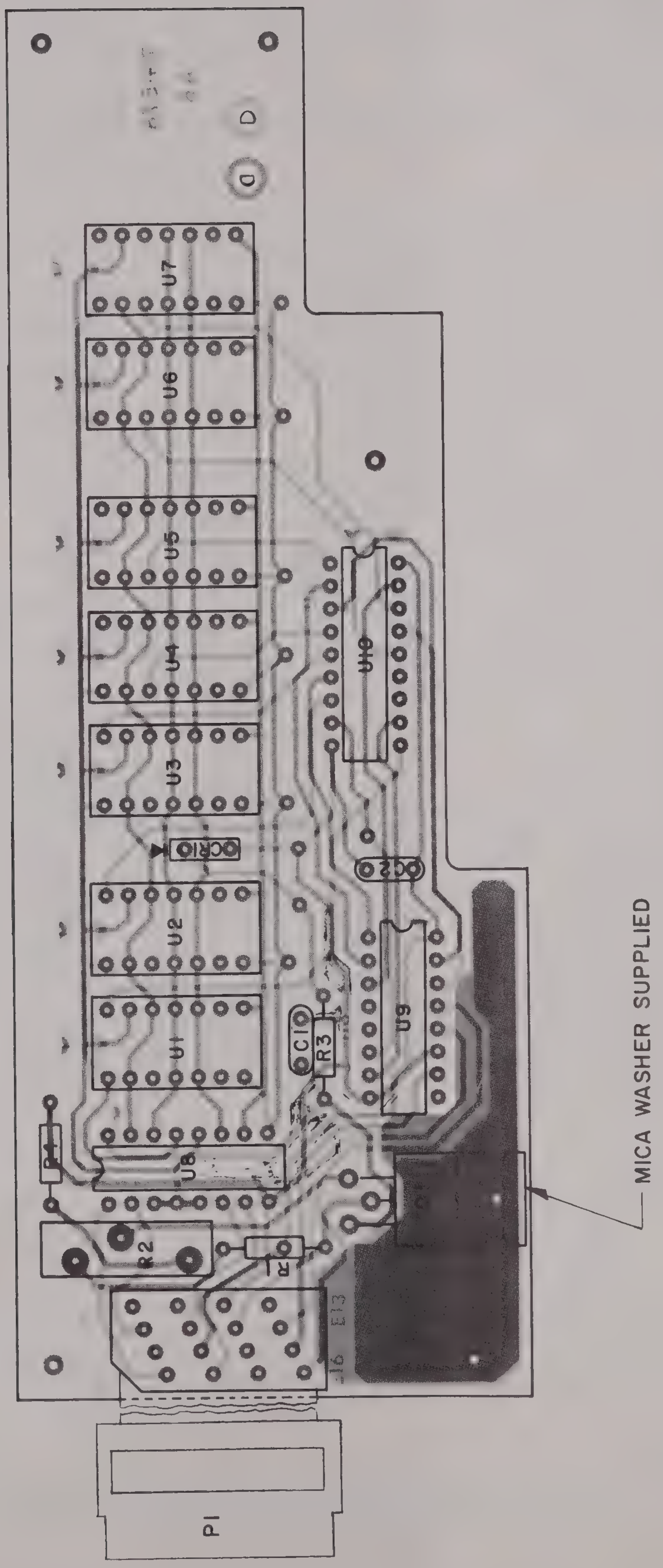

U7
U6
U5
U4
U3
U2
U1
U8
U9
U10
CR1
C1
C2
R1
R2
R3
R4
E13
16
P1
MICA WASHER SUPPLIED

Figure 5-34. Type 791578 Frequency Display (A8), Location of Components

5.5.9 TYPE 791827 BFO SWITCH

REF DESIG PREFIX A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
E17	Terminal	1	140-1941-02-01	71279	
P1	Connector	1	88011-2	00779	
S1	Switch	1	339910490-00126	09353	

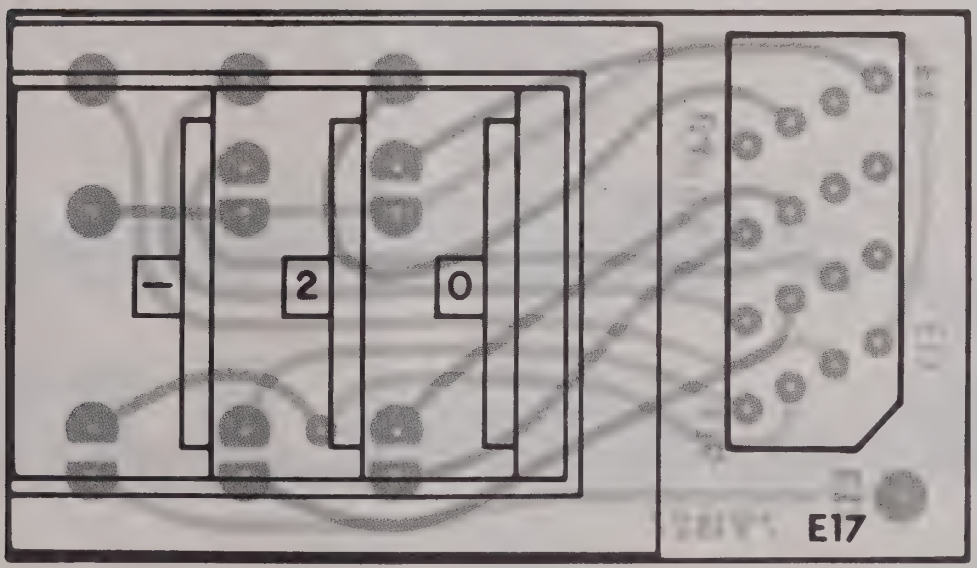


Figure 5-35. Type 791827 BFO Switch (A9), Location of Components

5.5.10 TYPE 791684 FRONT PANEL CONTROL REF DESIG PREFIX A10

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	Upper Panel Control	1	791583	14632	
A2	Lower Panel Control	1	791584	14632	
P1	Connector, Receptacle, Multipin	1	86896-2	00779	

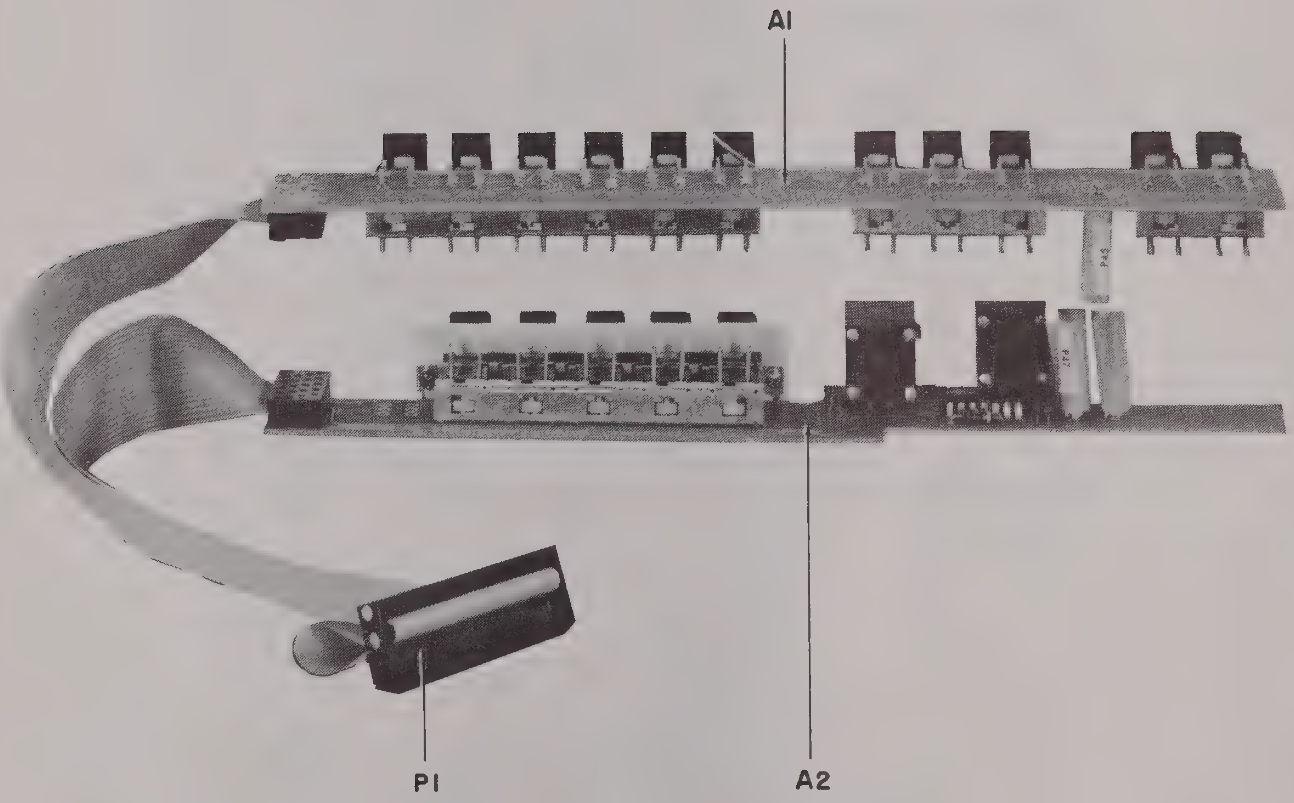


Figure 5-36. Type 791684 Front Panel Control (A10), Location of Components

5.5.10.1 Type 791583 Upper Panel Control

REF DESIG PREFIX A10A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
S1	Switch, Push Button	1	18485	14632	
S2	Switch, Push Button	1	18486	14632	
S3	Switch, Push Button	1	18487	14632	

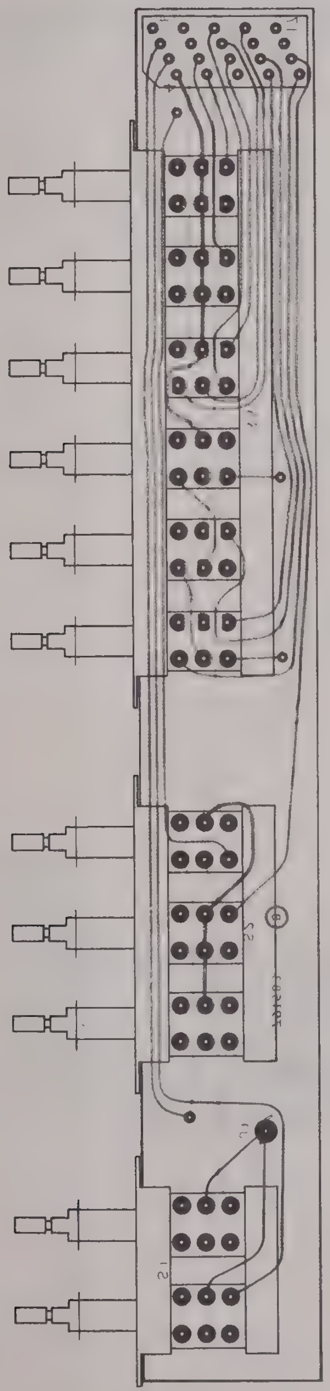


Figure 5-37. Type 791583 Upper Panel Control (A10A1), Location of Components

5.5.10.2 Type 791826 Lower Panel Control REF DESIG PREFIX A10A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
J1	Faston Tables	4	62073-1	00779	
J2	Same as J1				
J3	Same as J1				
J4	Same as J1				
R1	Resistor, Variable, Composition: 25 kΩ, 10%, 1 W	1	70M3N056L253U	01121	
R2	Resistor, Variable, Composition, Dual: 25 k/25 kΩ, 10%, 1 W	1	70P3N056L253U	01121	
R3	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	2	RCR07G221JS	81349	01121
R4	Same as R3				
R5	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	2	RCR07G104JS	81349	01121
R6	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W	2	RCR07G102JS	81349	01121
R7	Same as R5				
R8	Same as R6				
S1	Switch, Pushbutton	1	PB15-5STA	71590	
U1	Integrated Circuit	1	MC3403P	04713	

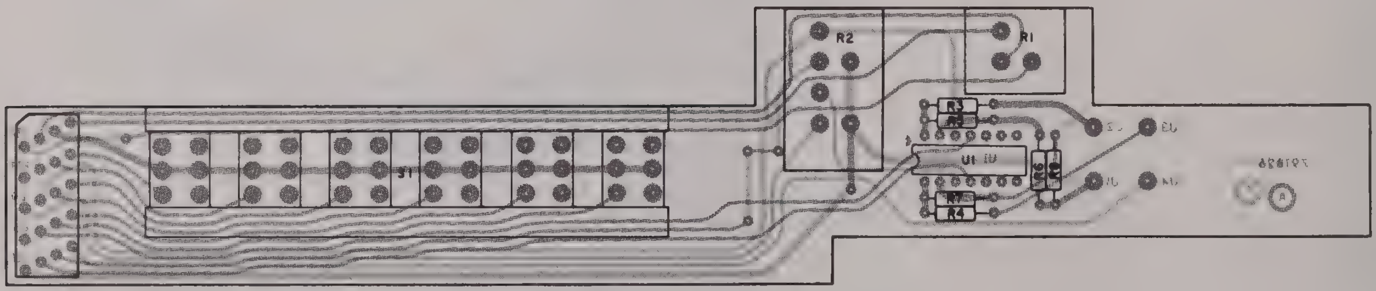


Figure 5-38. Type 791826 Lower Panel Control (A10A2), Location of Components

SECTION VI
SCHEMATIC DIAGRAMS

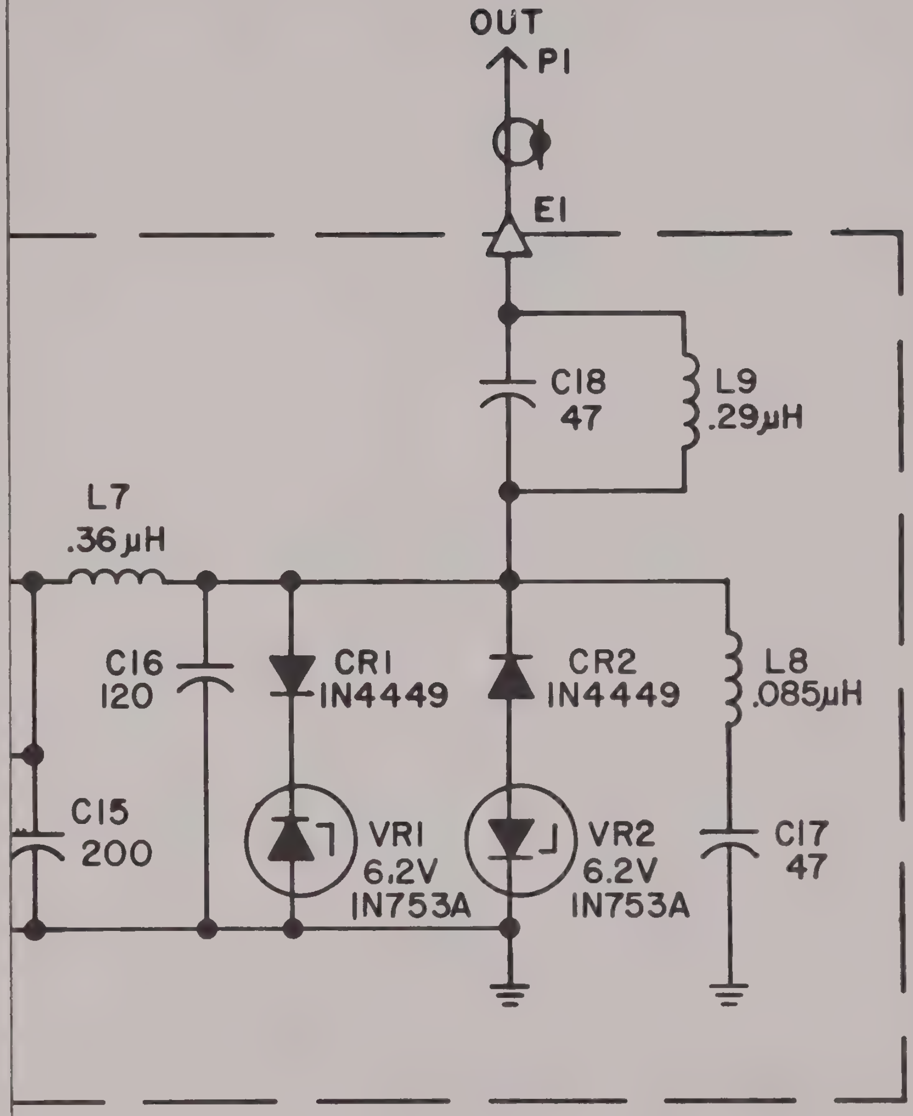
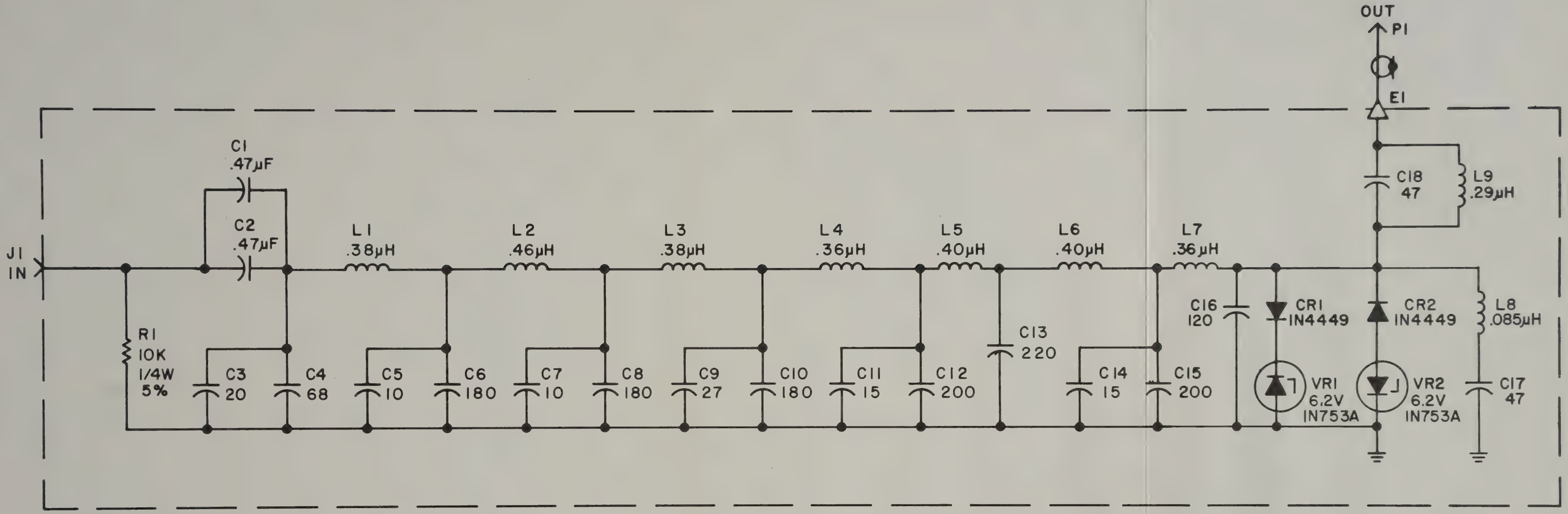

OUT
P1
E1
C18
47
L9
.29µH
L7
.36µH
C16
120
CR1
1N4449
CR2
1N4449
L8
.085µH
C15
200
VR1
6.2V
1N753A
VR2
6.2V
1N753A
C17
47

Figure 6-1. Type 791616 RF Filter (A2), Schematic Diagram 34437 6-1


OUT
P1
E1
J1
IN
C1
.47μF
C2
.47μF
L1
.38μH
L2
.46μH
L3
.38μH
L4
.36μH
L5
.40μH
L6
.40μH
L7
.36μH
C18
47
L9
.29μH
R1
10K
1/4W
5%
C3
20
C4
68
C5
10
C6
180
C7
10
C8
180
C9
27
C10
180
C11
15
C12
200
C13
220
C14
15
C15
200
C16
120
CR1
1N4449
CR2
1N4449
L8
.085μH
VR1
6.2V
1N753A
VR2
6.2V
1N753A
C17
47

NOTE: UNLESS SPECIFIED,
a) RESISTANCE IS IN OHMS.
b) CAPACITANCE IS pF

Figure 6-1. Type 791616 RF Filter (A2), Schematic Diagram 34437 6-1

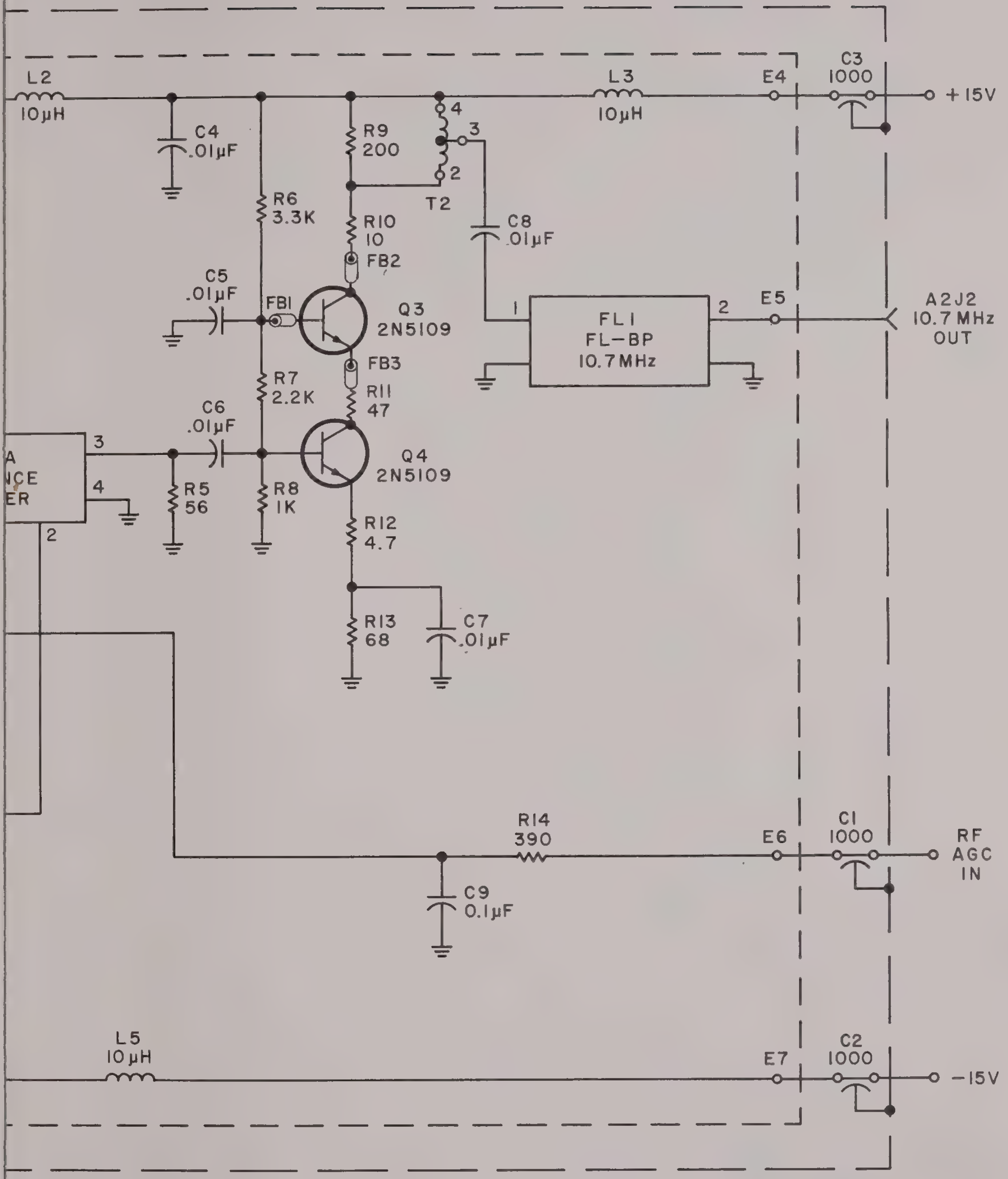
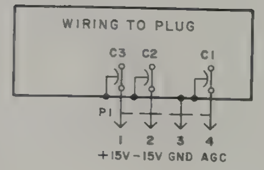
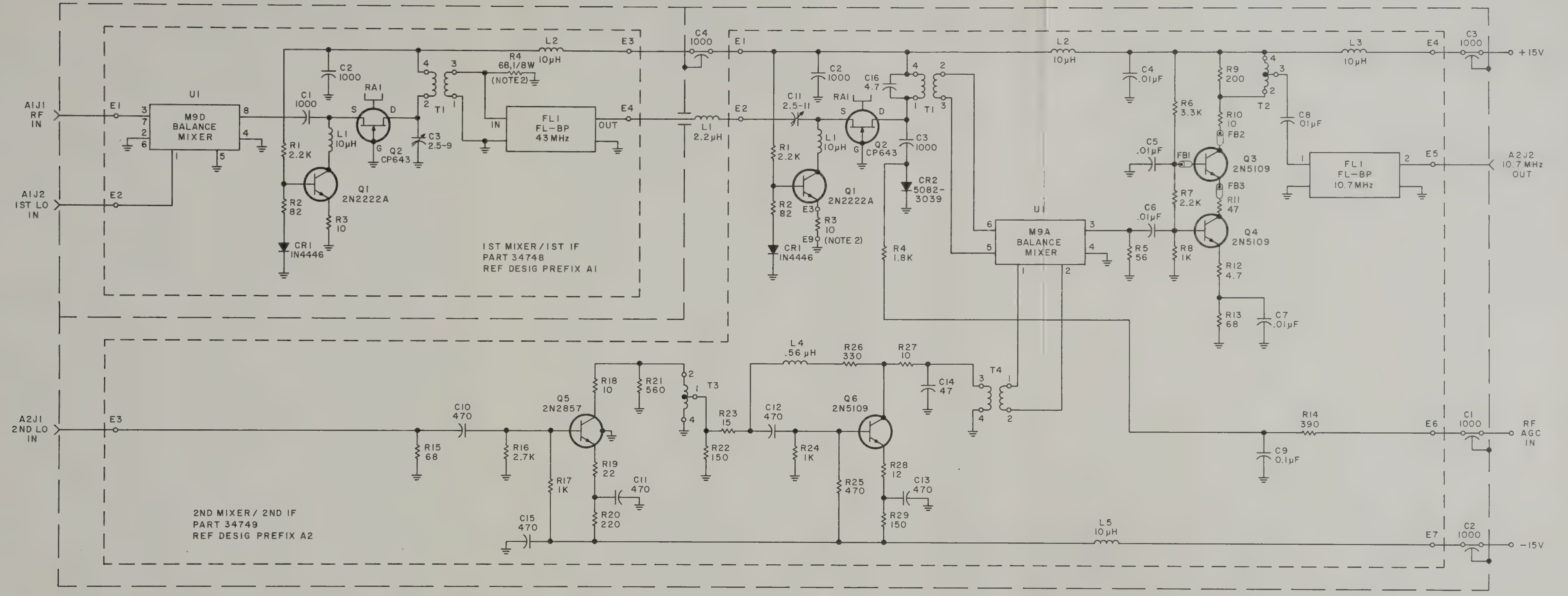

L2
10μH
C4
.01μF
R6
3.3K
R9
200
4
3
2
T2
R10
10
FB2
C8
.01μF
L3
10μH
E4
C3
1000
+15V
C5
.01μF
FB1
Q3
2N5109
FB3
FL1
FL-BP
10.7MHz
1
2
E5
A2J2
10.7 MHz
OUT
R7
2.2K
R11
47
C6
.01μF
A
NCE
ER
3
4
2
R5
56
R8
1K
Q4
2N5109
R12
4.7
R13
68
C7
.01μF
R14
390
E6
C1
1000
RF
AGC
IN
C9
0.1μF
L5
10μH
E7
C2
1000
-15V

Figure 6-2. Type 791592 Input Converter (A3), Schematic Diagram 51178

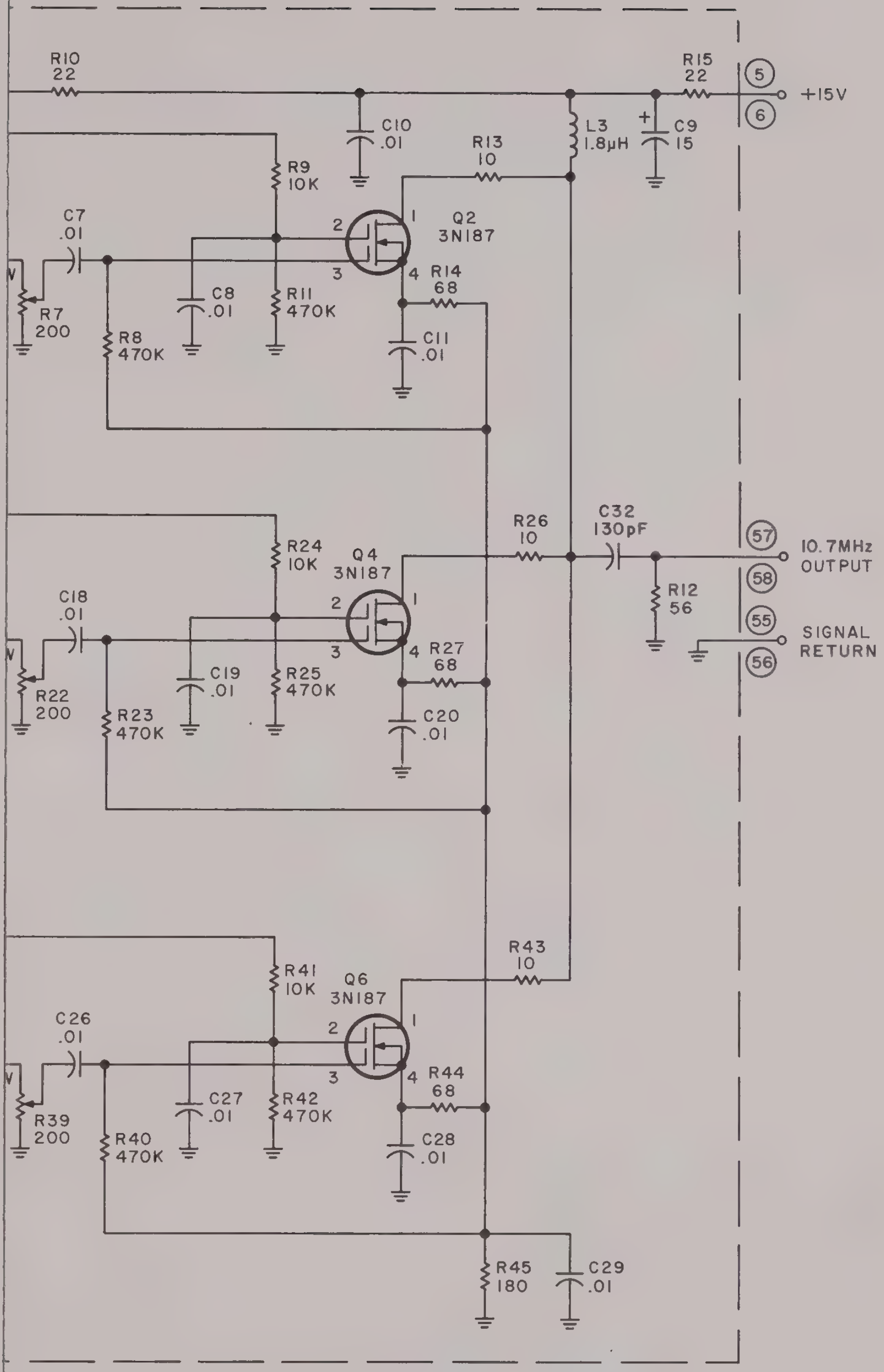

WIRING TO PLUG
C3 C2 C1
P1
1 2 3 4
+15V -15V GND AGC


A1J1 RF IN
A1J2 1ST LO IN
A2J1 2ND LO IN
E1
E2
E3
E4
U1
M9D BALANCE MIXER
C1 1000
C2 1000
RA1
Q2 CP643
L1 10μH
R1 2.2K
R2 82
Q1 2N2222A
R3 10
CR1 1N4446
T1
C3 2.5-9
L2 10μH
R4 68,1/8W (NOTE 2)
FL1 FL-BP 43MHz
IN
OUT
1ST MIXER/1ST IF
PART 34748
REF DESIG PREFIX A1
C4 1000
L1 2.2μH
C11 2.5-11
C16 4.7
C3 1000
CR2 5082-3039
E3
E9
R3 10 (NOTE 2)
R4 1.8K
M9A BALANCE MIXER
R5 56
C4 .01μF
C5 .01μF
C6 .01μF
FB1
FB2
FB3
R6 3.3K
R7 2.2K
R8 1K
R9 200
R10 10
R11 47
R12 4.7
R13 68
C7 .01μF
C8 .01μF
Q3 2N5109
Q4 2N5109
T2
L3 10μH
FL1 FL-BP 10.7MHz
E5
A2J2 10.7 MHz OUT
C3 1000
+15V
2ND MIXER/ 2ND IF
PART 34749
REF DESIG PREFIX A2
C10 470
R15 68
R16 2.7K
Q5 2N2857
R17 1K
R18 10
R19 22
R20 220
R21 560
C11 470
C15 470
T3
R22 150
R23 15
C12 470
R24 1K
L4 .56μH
R26 330
R27 10
C14 47
Q6 2N5109
R25 470
R28 12
C13 470
R29 150
T4
R14 390
C9 0.1μF
E6
C1 1000
RF AGC IN
L5 10μH
E7
C2 1000
-15V

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
2. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.

Figure 6-2. Type 791592 Input Converter (A3), Schematic Diagram 51178


R10
22
R15
22
5
6
+15V
C10
.01
R13
10
L3
1.8µH
+
C9
15
R9
10K
C7
.01
2
1
Q2
3N187
3
4
R14
68
C8
.01
R11
470K
R7
200
R8
470K
C11
.01
R26
10
C32
130pF
57
10.7MHz
OUTPUT
58
R24
10K
Q4
3N187
C18
.01
2
1
R12
56
55
SIGNAL
RETURN
56
3
4
R27
68
C19
.01
R25
470K
R22
200
R23
470K
C20
.01
R43
10
R41
10K
Q6
3N187
C26
.01
2
1
3
4
R44
68
C27
.01
R42
470K
R39
200
R40
470K
C28
.01
R45
180
C29
.01

ure 6-3. Type 791594 10.7 MHz Filter Switch (A4A1), Schematic Diagram 51177

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.

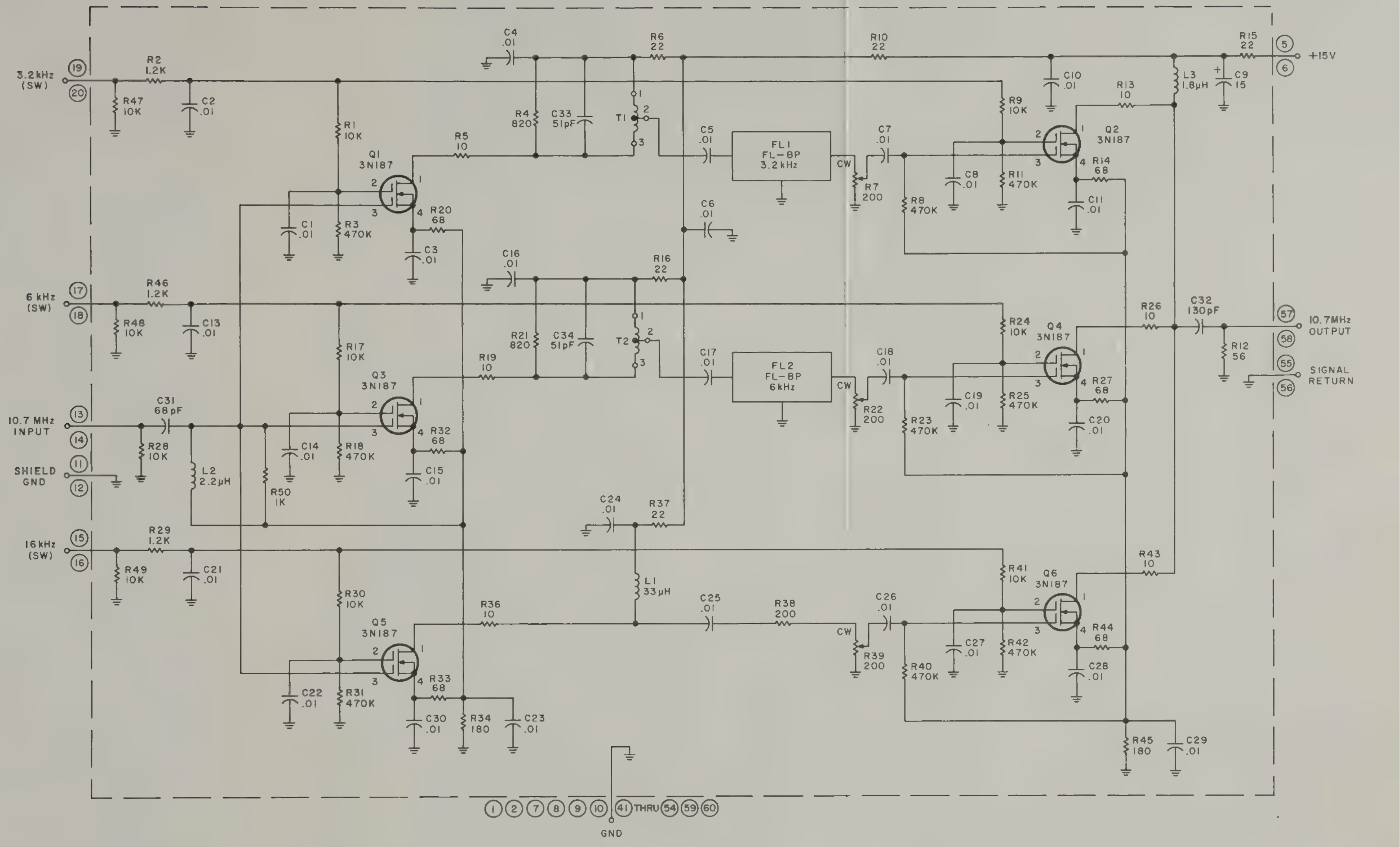
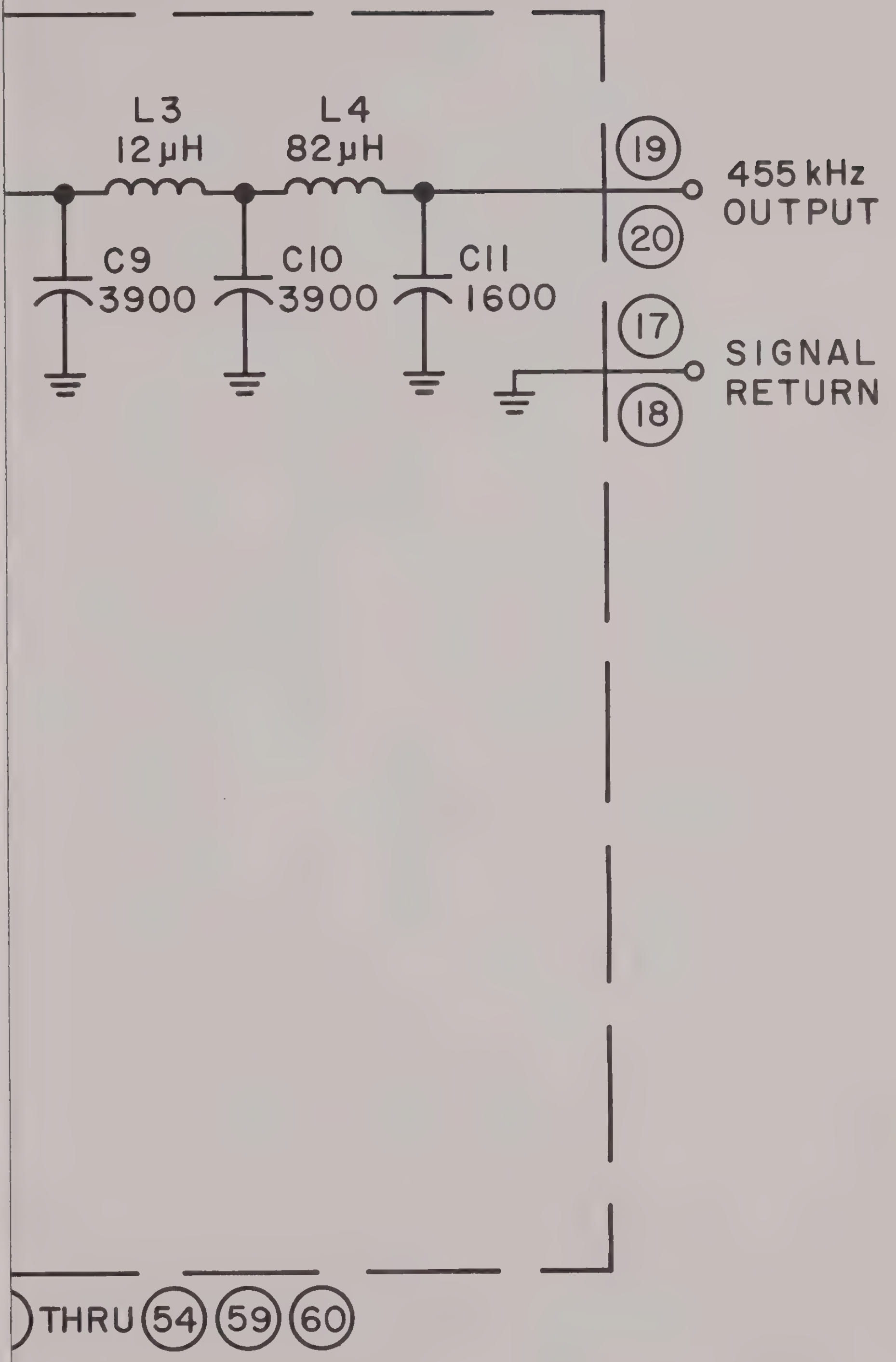
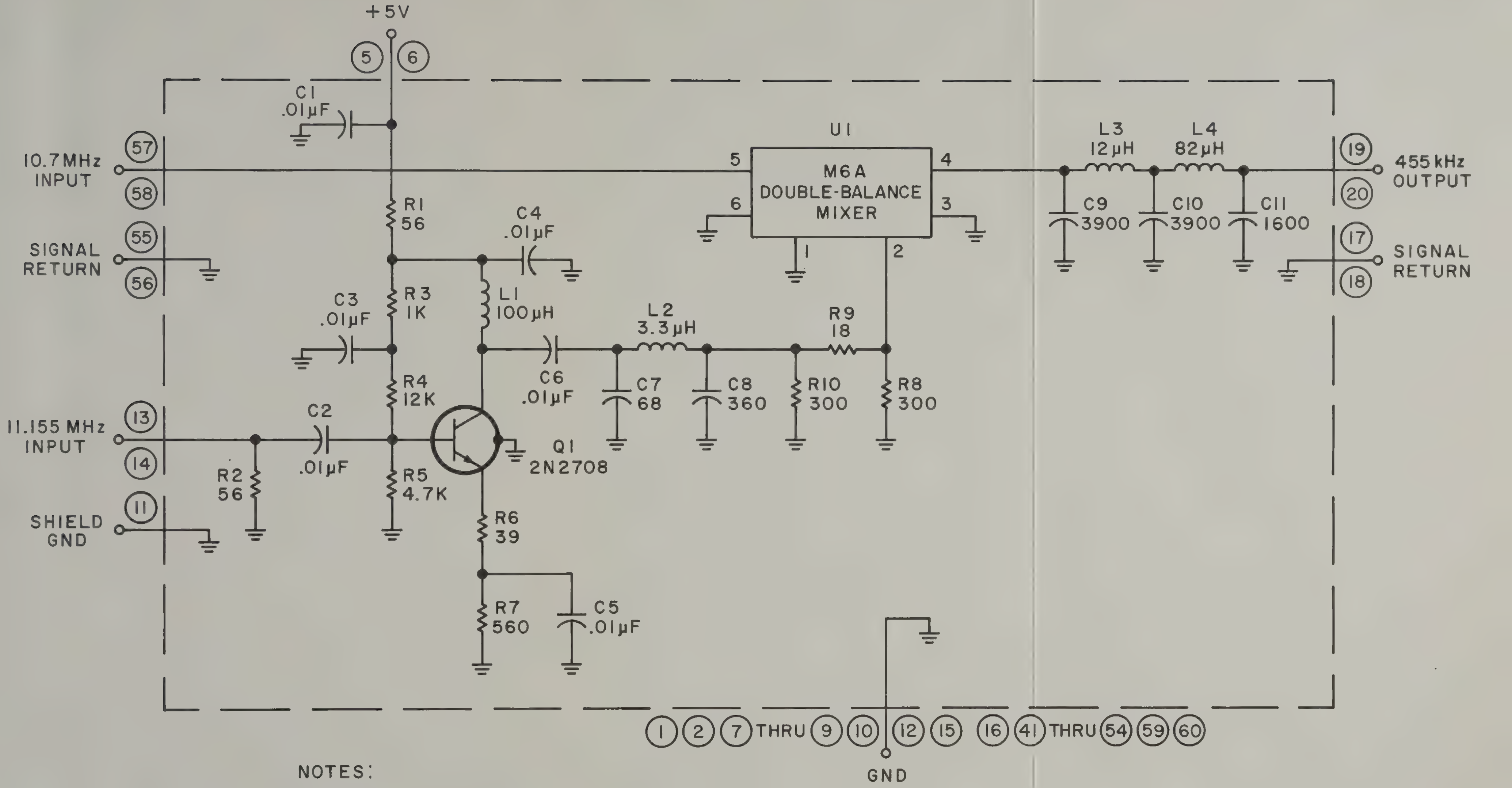

3.2 kHz (SW)
⑲
⑳
R2 1.2K
R47 10K
C2 .01
6 kHz (SW)
⑰
⑱
R46 1.2K
R48 10K
C13 .01
10.7 MHz INPUT
⑬
⑭
C31 68 pF
R28 10K
L2 2.2μH
R50 1K
SHIELD GND
⑪
⑫
16 kHz (SW)
⑮
⑯
R29 1.2K
R49 10K
C21 .01
C4 .01
R6 22
R10 22
R15 22
⑤
⑥
+15V
C10 .01
L3 1.8μH
C9 15
R13 10
R9 10K
Q2 3N187
R14 68
R11 470K
C8 .01
C11 .01
R8 470K
C7 .01
R7 200
CW
FL1 FL-BP 3.2 kHz
C5 .01
T1
R4 820
C33 51pF
R5 10
R1 10K
Q1 3N187
C1 .01
R3 470K
R20 68
C3 .01
C6 .01
C16 .01
R16 22
R21 820
C34 51pF
T2
R19 10
R17 10K
Q3 3N187
C14 .01
R18 470K
R32 68
C15 .01
C17 .01
FL2 FL-BP 6 kHz
R22 200
C18 .01
R23 470K
C19 .01
R24 10K
Q4 3N187
R25 470K
R27 68
C20 .01
R26 10
C32 130pF
R12 56
57
58
55
56
10.7MHz OUTPUT
SIGNAL RETURN
C24 .01
R37 22
L1 33μH
R30 10K
Q5 3N187
R36 10
C22 .01
R31 470K
R33 68
C30 .01
R34 180
C23 .01
C25 .01
R38 200
C26 .01
R39 200
R40 470K
C27 .01
R41 10K
Q6 3N187
R42 470K
R44 68
C28 .01
R43 10
R45 180
C29 .01
① ② ⑦ ⑧ ⑨ ⑩ ㊶ THRU (54) (59) (60)
GND

Figure 6-3. Type 791594 10.7 MHz Filter Switch (A4A1), Schematic Diagram 51177


L3
12µH
L4
82µH
C9
3900
C10
3900
C11
1600
19
20
455 kHz
OUTPUT
17
18
SIGNAL
RETURN
THRU
54
59
60

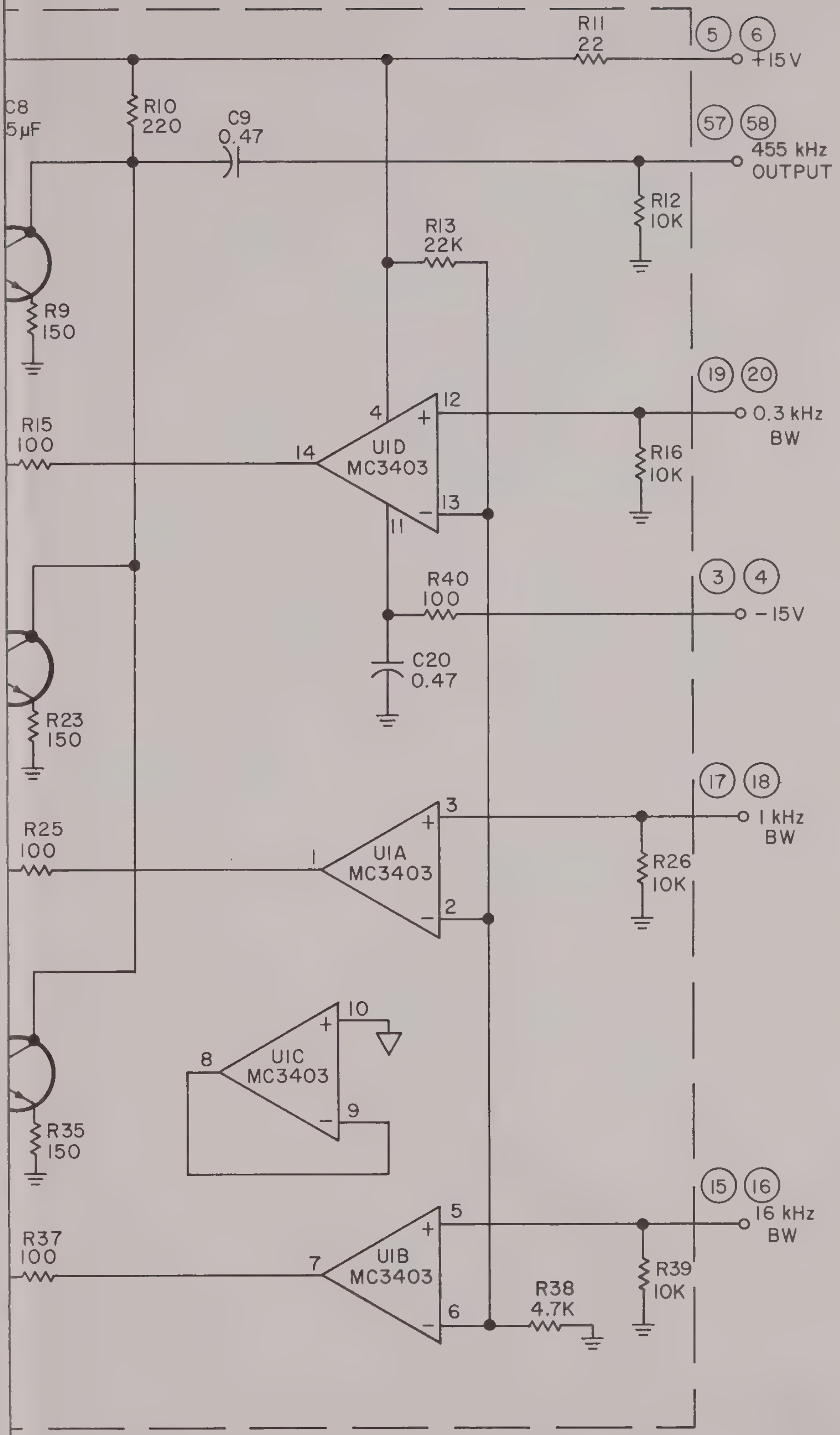
-4. Type 71430 10.7 MHz/455 kHz Converter (A4A2), Schematic Diagram 34384


+5V
5
6
C1
.01μF
10.7MHz INPUT
57
58
R1
56
SIGNAL RETURN
55
56
C4
.01μF
R3
1K
C3
.01μF
L1
100μH
U1
M6A DOUBLE-BALANCE MIXER
5
6
4
3
1
2
L2
3.3μH
R9
18
C6
.01μF
C7
68
C8
360
R10
300
R8
300
R4
12K
11.155 MHz INPUT
13
14
C2
.01μF
R2
56
Q1
2N2708
R5
4.7K
SHIELD GND
11
R6
39
R7
560
C5
.01μF
L3
12μH
L4
82μH
C9
3900
C10
3900
C11
1600
19
20
455 kHz OUTPUT
17
18
SIGNAL RETURN
1
2
7
THRU
9
10
12
15
16
41
THRU
54
59
60
GND

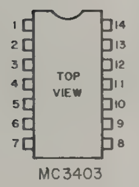
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.

Figure 6-4. Type 71430 10.7 MHz/455 kHz Converter (A4A2), Schematic Diagram 34384


R11
22
5
6
+15V
C8
5µF
R10
220
C9
0.47
57
58
455 kHz
OUTPUT
R12
10K
R13
22K
R9
150
19
20
0.3 kHz
BW
R15
100
4
12
14
U1D
MC3403
13
11
R16
10K
R40
100
3
4
-15V
C20
0.47
R23
150
17
18
1 kHz
BW
R25
100
3
1
U1A
MC3403
2
R26
10K
10
U1C
MC3403
8
9
R35
150
15
16
16 kHz
BW
R37
100
5
7
U1B
MC3403
6
R38
4.7K
R39
10K

igure 6-5. Type 791595 455 kHz Filter Switch (A4A3), Schematic Diagram 43561


1
2
3
4
5
6
7
14
13
12
11
10
9
8
TOP VIEW
MC3403

NOTES
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ± 5%, 1/4W.
   b) CAPACITANCE IS IN µF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.

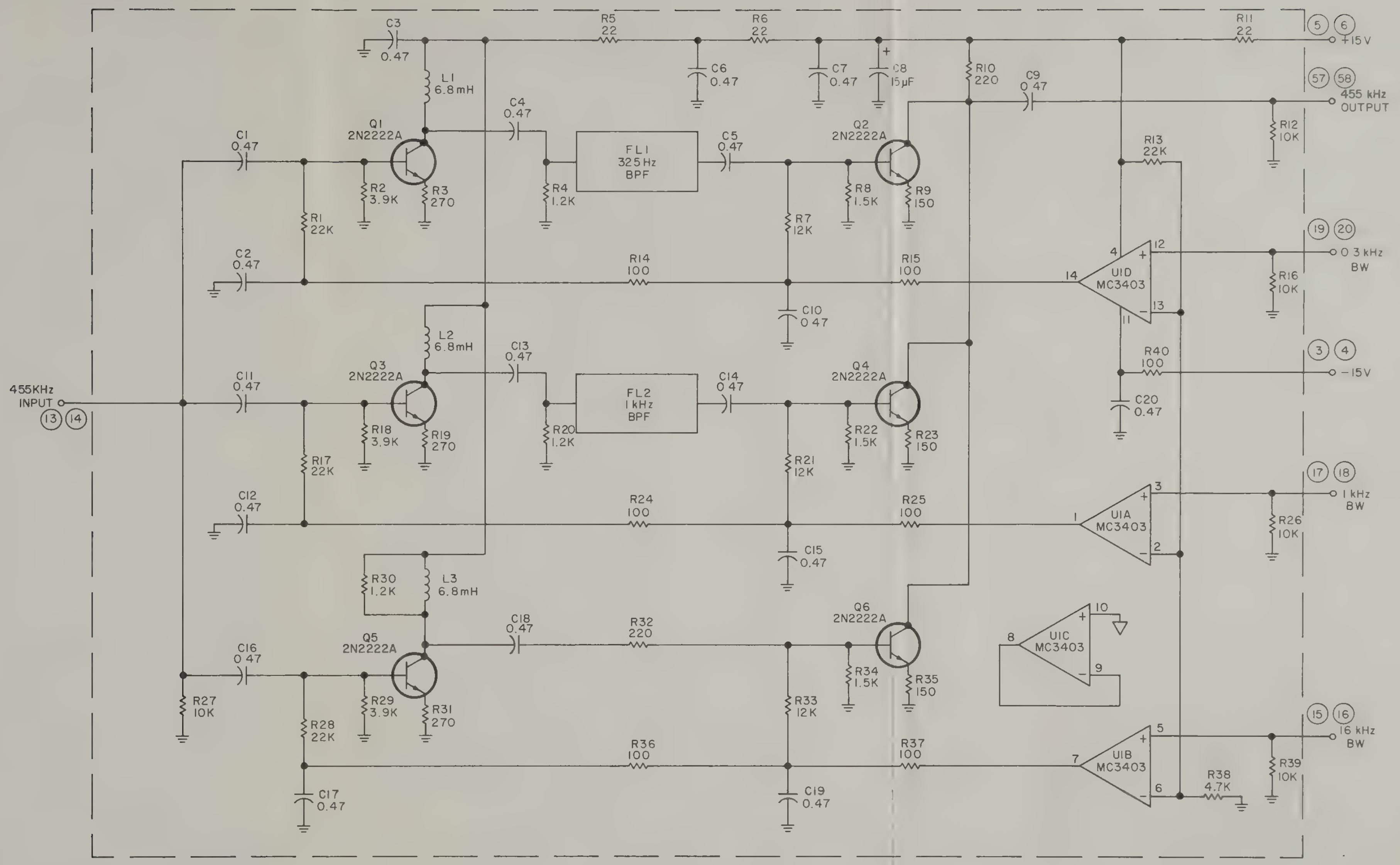

455KHz INPUT
13
14
C3 0.47
L1 6.8mH
Q1 2N2222A
C1 0.47
R2 3.9K
R3 270
R1 22K
C2 0.47
C4 0.47
FL1 325 Hz BPF
R4 1.2K
C5 0.47
R5 22
R6 22
C6 0.47
C7 0.47
C8 15µF
R7 12K
R8 1.5K
Q2 2N2222A
R9 150
R10 220
C9 0.47
R11 22
5
6
+15V
57
58
455 kHz OUTPUT
R12 10K
R13 22K
R14 100
R15 100
C10 0.47
U1D MC3403
4
12
14
13
11
19
20
0.3 kHz BW
R16 10K
L2 6.8mH
Q3 2N2222A
C11 0.47
R18 3.9K
R19 270
R17 22K
C12 0.47
C13 0.47
FL2 1 kHz BPF
R20 1.2K
C14 0.47
R21 12K
R22 1.5K
Q4 2N2222A
R23 150
R40 100
C20 0.47
3
4
-15V
R24 100
R25 100
C15 0.47
U1A MC3403
1
3
2
17
18
1 kHz BW
R26 10K
R30 1.2K
L3 6.8mH
Q5 2N2222A
C16 0.47
R27 10K
R29 3.9K
R31 270
R28 22K
C17 0.47
C18 0.47
R32 220
R33 12K
R34 1.5K
Q6 2N2222A
R35 150
U1C MC3403
8
10
9
R36 100
R37 100
C19 0.47
U1B MC3403
5
7
6
R38 4.7K
15
16
16 kHz BW
R39 10K

Figure 6-5. Type 791595 455 kHz Filter Switch (A4A3), Schematic Diagram 43561

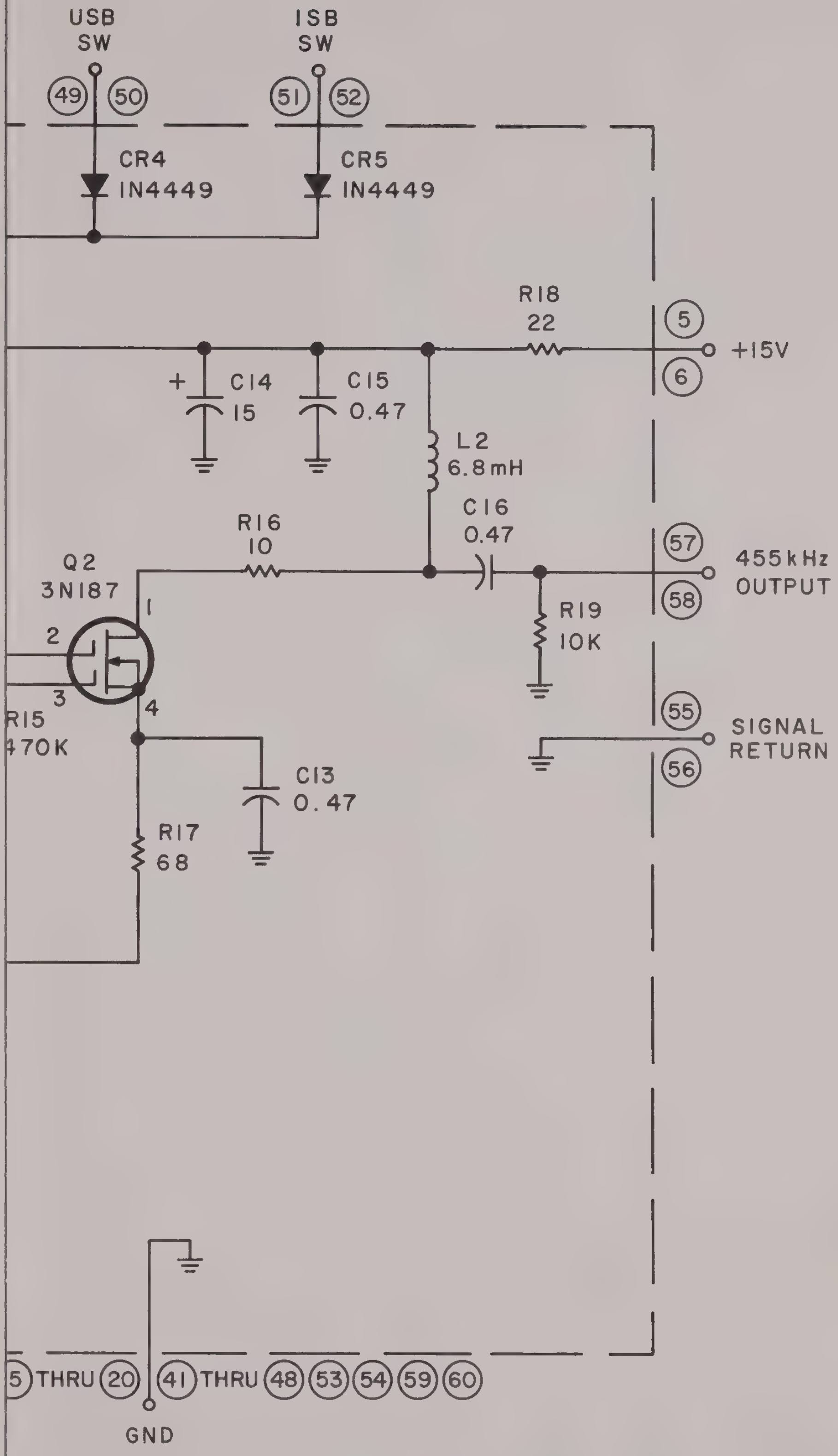
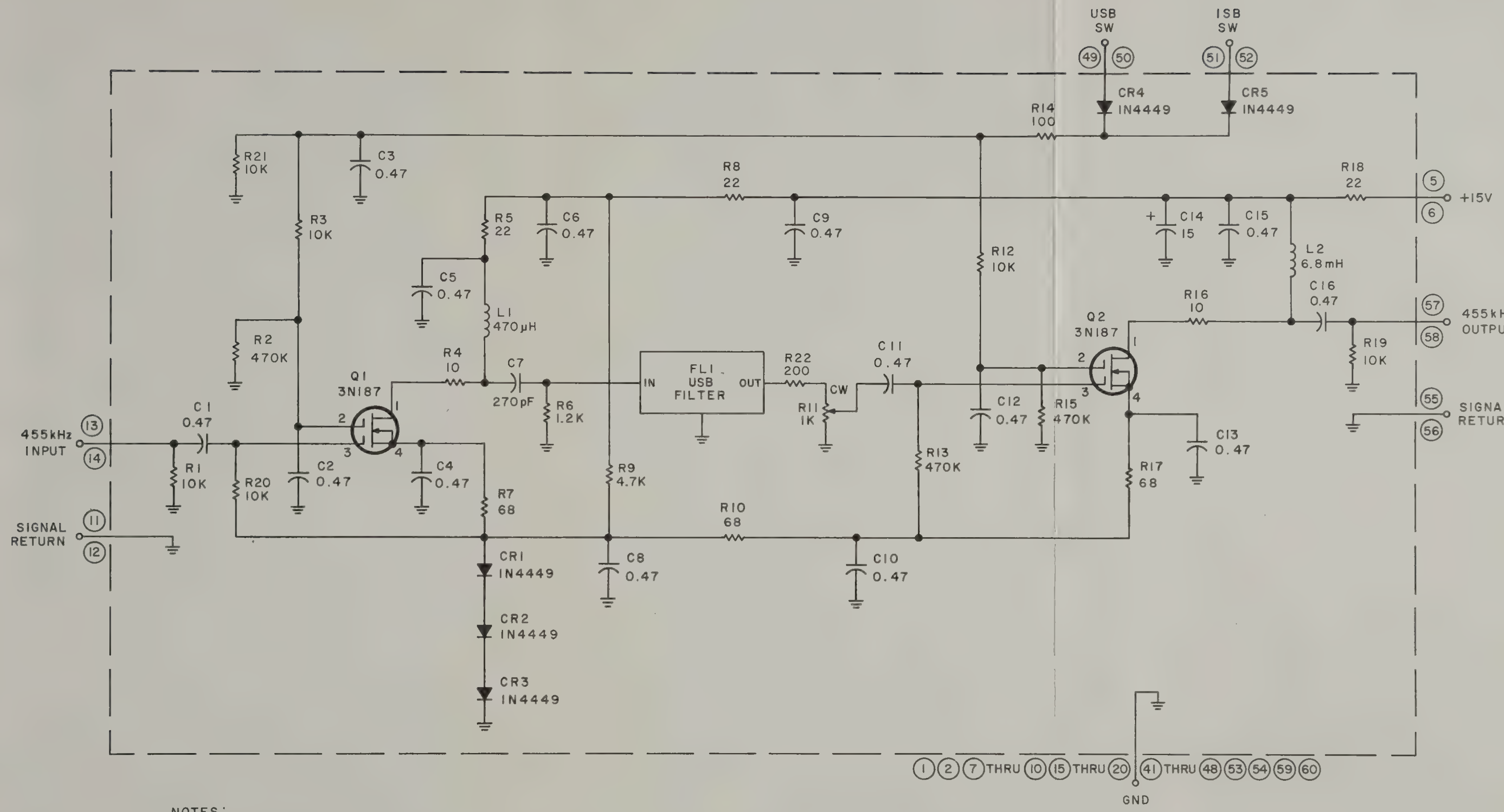

USB
SW
(49)
(50)
ISB
SW
(51)
(52)
CR4
IN4449
CR5
IN4449
R18
22
(5)
+15V
(6)
C14
15
C15
0.47
L2
6.8mH
R16
10
C16
0.47
(57)
455kHz
OUTPUT
(58)
Q2
3N187
1
2
3
4
R19
10K
R15
470K
(55)
SIGNAL
RETURN
(56)
C13
0.47
R17
68
5) THRU (20)
(41) THRU (48) (53) (54) (59) (60)
GND

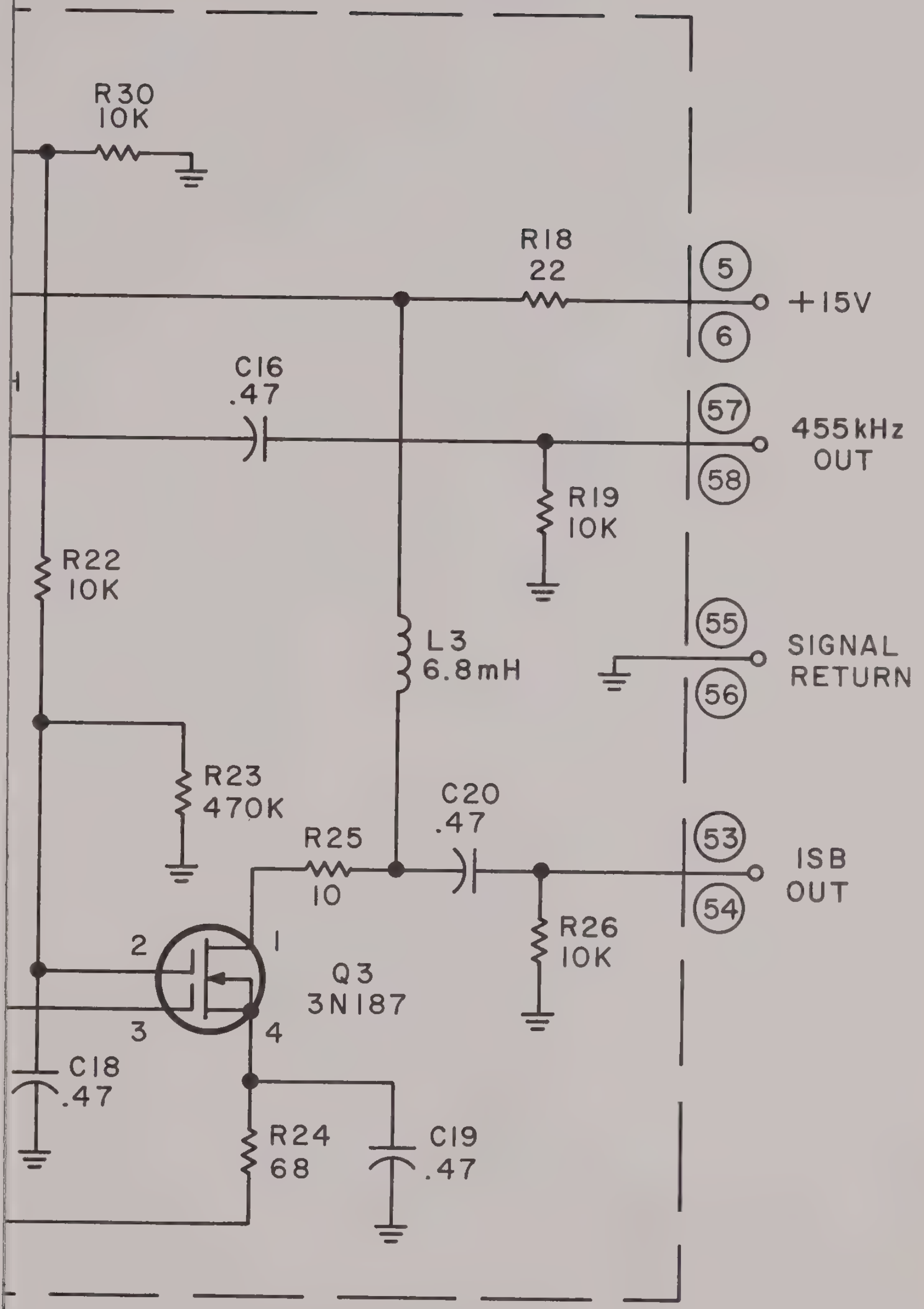
Figure 6-6. Type 791596 USB Filter Switch (A4A4), Schematic Diagram 43196


USB SW
(49) (50)
ISB SW
(51) (52)
CR4 IN4449
CR5 IN4449
R14 100
R21 10K
C3 0.47
R3 10K
R8 22
R18 22
(5) (6) +15V
R5 22
C6 0.47
C9 0.47
C14 15
C15 0.47
C5 0.47
R12 10K
L2 6.8mH
L1 470μH
C16 0.47
R16 10
(57) (58) 455kHz OUTPUT
Q2 3N187
R2 470K
R4 10
C7 270pF
FL1 USB FILTER
IN
OUT
R22 200
C11 0.47
R19 10K
Q1 3N187
CW
R11 1K
(55) (56) SIGNAL RETURN
C1 0.47
R6 1.2K
C12 0.47
R15 470K
455kHz INPUT (13) (14)
C13 0.47
R1 10K
R20 10K
C2 0.47
C4 0.47
R9 4.7K
R13 470K
R17 68
R7 68
SIGNAL RETURN (11) (12)
R10 68
CR1 IN4449
C8 0.47
C10 0.47
CR2 IN4449
CR3 IN4449
(1) (2) (7) THRU (10) (15) THRU (20) (41) THRU (48) (53) (54) (59) (60)
GND

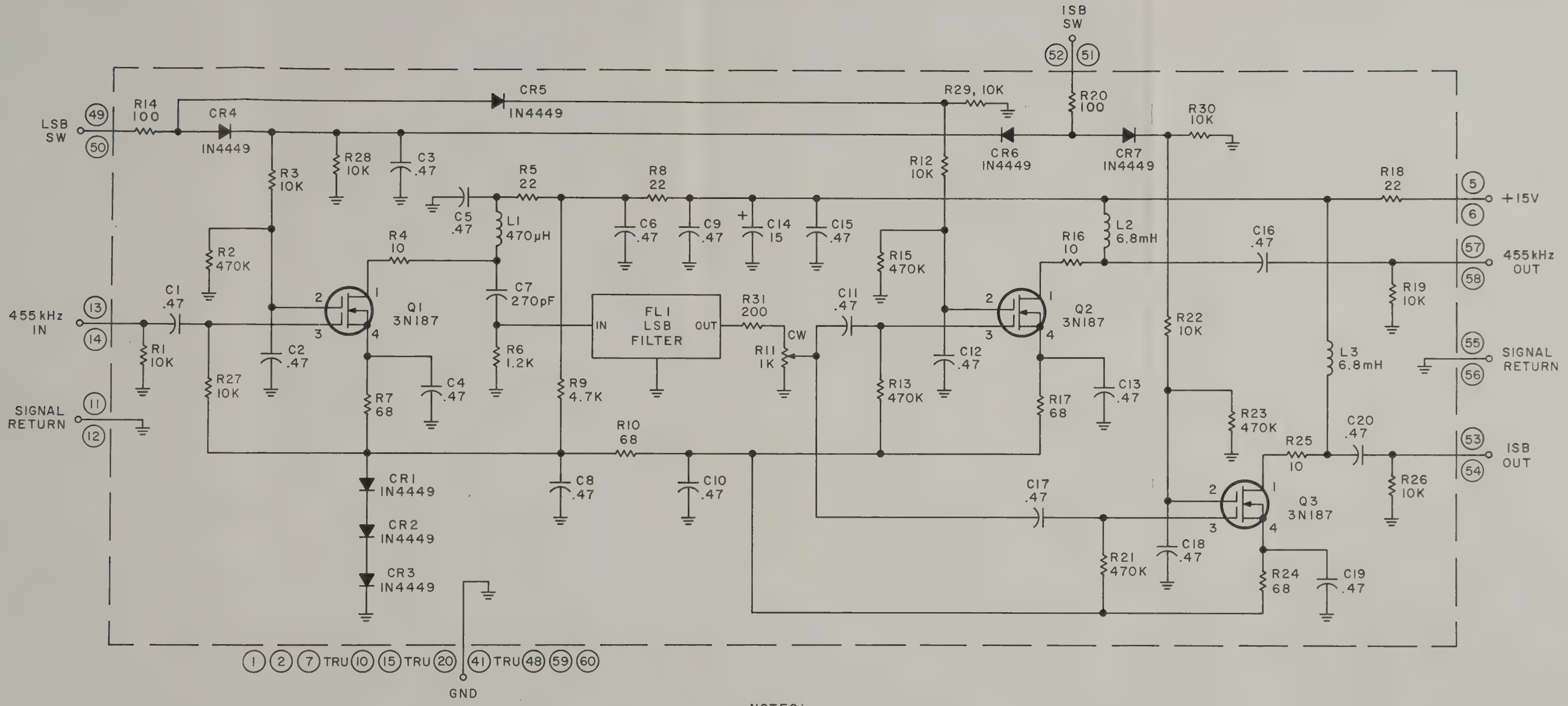
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS (LETTERS) ARE MODULE PIN NUMBERS

HIGHEST REF DESIG USED	REF DESIG NOT USED
C16 CR5 FL1 L2 Q2 R22	

Figure 6-6. Type 791596 USB Filter Switch (A4A4), Schematic Diagram 43196


R30
10K
R18
22
5
6
+15V
C16
.47
57
58
455kHz
OUT
R19
10K
R22
10K
L3
6.8mH
55
56
SIGNAL
RETURN
R23
470K
C20
.47
R25
10
53
54
ISB
OUT
2
1
3
4
Q3
3N187
R26
10K
C18
.47
R24
68
C19
.47

re 6-7. Type 791597 ISB/LSB Filter Switch (A4A5), Schematic Diagram 43249


ISB SW
52
51
R20 100
R29, 10K
CR5 IN4449
LSB SW
49
50
R14 100
CR4 IN4449
R28 10K
C3 .47
R3 10K
R2 470K
CR6 IN4449
CR7 IN4449
R30 10K
R12 10K
R18 22
5
6
+15V
C5 .47
R5 22
R8 22
L1 470µH
C6 .47
C9 .47
C14 15
C15 .47
R15 470K
L2 6.8mH
R4 10
R16 10
C16 .47
57
58
455kHz OUT
R19 10K
455 kHz IN
13
14
C1 .47
R1 10K
C2 .47
Q1 3N187
C7 270pF
R6 1.2K
FL1 LSB FILTER
IN
OUT
R31 200
CW
R11 1K
C11 .47
R13 470K
C12 .47
Q2 3N187
R22 10K
L3 6.8mH
55
56
SIGNAL RETURN
R27 10K
R7 68
C4 .47
R9 4.7K
R17 68
C13 .47
R23 470K
SIGNAL RETURN
11
12
R10 68
R25 10
C20 .47
53
54
ISB OUT
R26 10K
CR1 IN4449
CR2 IN4449
CR3 IN4449
C8 .47
C10 .47
C17 .47
Q3 3N187
C18 .47
R21 470K
R24 68
C19 .47
1
2
7
TRU
10
15
TRU
20
41
TRU
48
59
60
GND

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN µF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.

Figure 6-7. Type 791597 ISB/LSB Filter Switch (A4A5), Schematic Diagram 43249

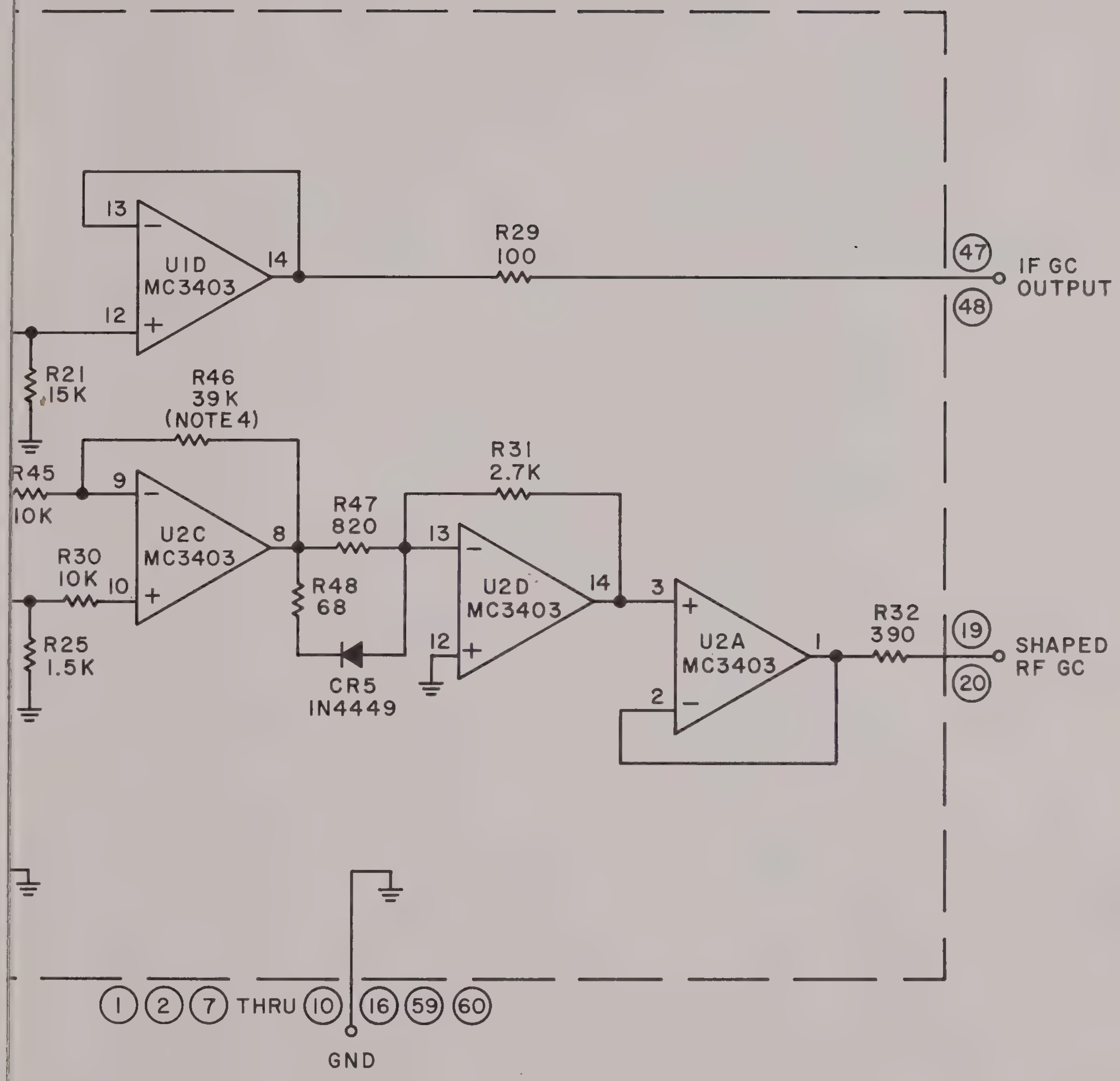
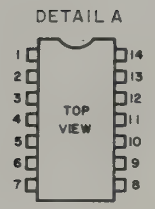

13
U1D
MC3403
14
12
R29
100
47
48
IF GC
OUTPUT
R21
15K
R46
39K
(NOTE 4)
R45
10K
9
U2C
MC3403
8
R30
10K
10
R25
1.5K
R47
820
R48
68
CR5
IN4449
R31
2.7K
13
U2D
MC3403
14
12
3
U2A
MC3403
1
2
R32
390
19
20
SHAPED
RF GC
1
2
7
THRU
10
16
59
60
GND

Figure 6-8. Type 78112 AGC (A4A6), Schematic Diagram 43229 6-15


DETAIL A
TOP VIEW
1
2
3
4
5
6
7
14
13
12
11
10
9
8

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN µF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.
3. U1, U2 LEAD ARRANGEMENT–DETAIL A.
4. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.

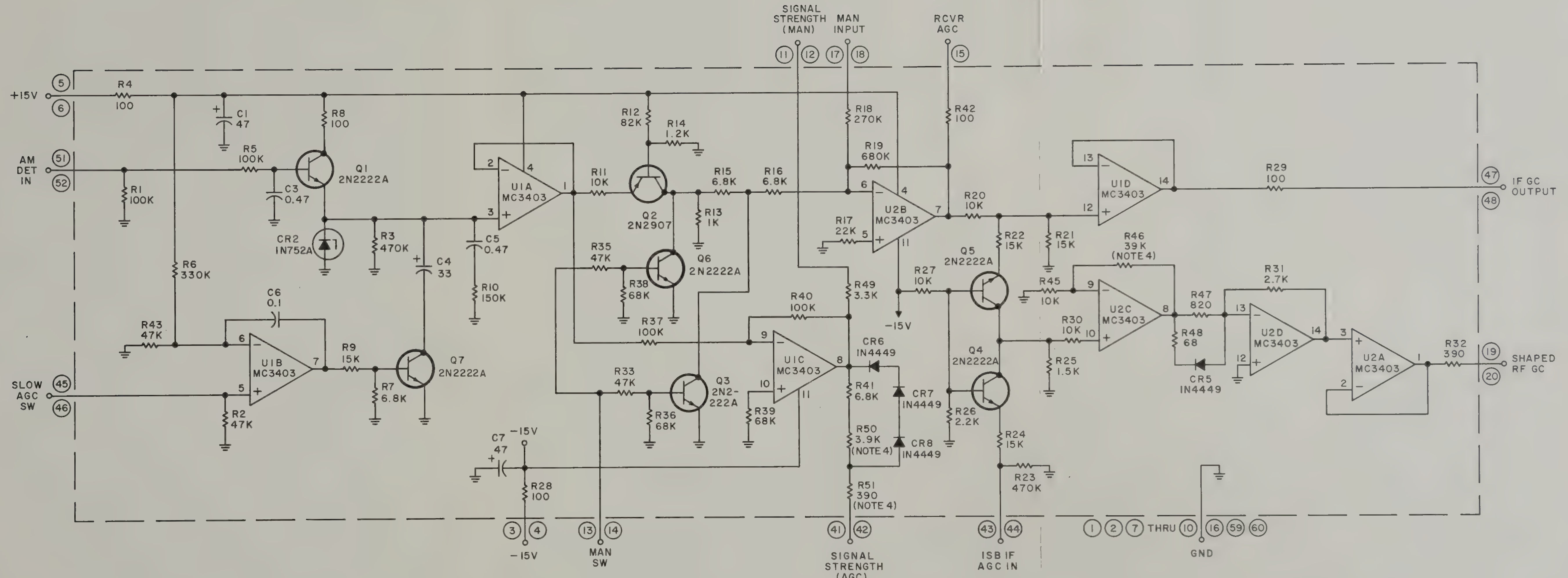
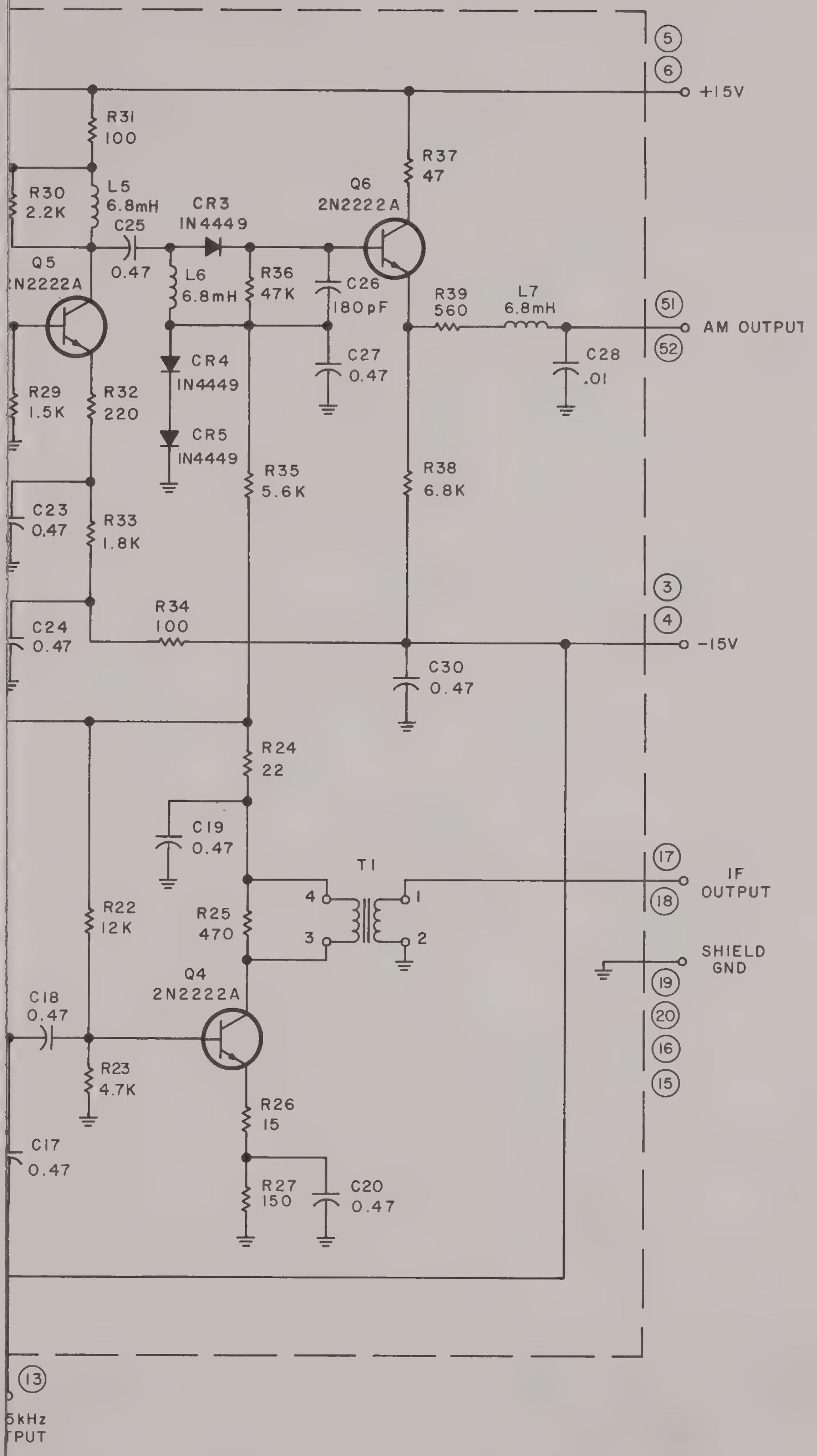

SIGNAL STRENGTH (MAN)
MAN INPUT
RCVR AGC
+15V
AM DET IN
SLOW AGC SW
IF GC OUTPUT
SHAPED RF GC
-15V
MAN SW
SIGNAL STRENGTH (AGC)
ISB IF AGC IN
GND
THRU
R4 100
C1 47
R8 100
R5 100K
Q1 2N2222A
R1 100K
C3 0.47
CR2 1N752A
R3 470K
C4 33
C5 0.47
R10 150K
R6 330K
C6 0.1
R43 47K
U1B MC3403
R2 47K
R9 15K
R7 6.8K
Q7 2N2222A
U1A MC3403
R11 10K
R12 82K
R14 1.2K
Q2 2N2907
R13 1K
R15 6.8K
R16 6.8K
R35 47K
R38 68K
Q6 2N2222A
R37 100K
R33 47K
R36 68K
Q3 2N2-222A
R39 68K
C7 47
R28 100
R18 270K
R19 680K
R17 22K
U2B MC3403
R42 100
R49 3.3K
R40 100K
U1C MC3403
CR6 1N4449
CR7 1N4449
CR8 1N4449
R41 6.8K
R50 3.9K (NOTE 4)
R51 390 (NOTE 4)
R20 10K
R22 15K
R21 15K
Q5 2N2222A
R27 10K
Q4 2N2222A
R26 2.2K
R24 15K
R23 470K
U1D MC3403
R29 100
R46 39K (NOTE 4)
R45 10K
U2C MC3403
R30 10K
R25 1.5K
R47 820
R48 68
CR5 1N4449
R31 2.7K
U2D MC3403
U2A MC3403
R32 390

Figure 6-8. Type 78112 AGC (A4A6), Schematic Diagram 43229 6-15


5
6
+15V
R31
100
R30
2.2K
L5
6.8mH
C25
0.47
CR3
IN4449
Q6
2N2222A
R37
47
Q5
2N2222A
L6
6.8mH
R36
47K
C26
180pF
R39
560
L7
6.8mH
51
AM OUTPUT
52
C27
0.47
C28
.01
CR4
IN4449
R29
1.5K
R32
220
CR5
IN4449
R35
5.6K
R38
6.8K
C23
0.47
R33
1.8K
3
4
R34
100
C24
0.47
-15V
C30
0.47
R24
22
C19
0.47
T1
17
IF
OUTPUT
18
4
1
3
2
R22
12K
R25
470
SHIELD
GND
19
Q4
2N2222A
20
16
15
C18
0.47
R23
4.7K
R26
15
C17
0.47
R27
150
C20
0.47
13
5kHz
TPUT

Type 72488 455 kHz Amplifier/AM Detector (A4A7), Schematic Diagram 51168

NOTES

1. UNLESS OTHERWISE SPECIFIED.
   a) RESISTANCE IS IN OHMS, ± 5%, 1/4W.
   b) CAPACITANCE IS µF.
2. ENCIRCLED NUMBERS (LETTERS) ARE MODULE PIN NUMBERS.
3. CW ON R7 INDICATES FULL CLOCKWISE POSITION OF ACTUATOR.

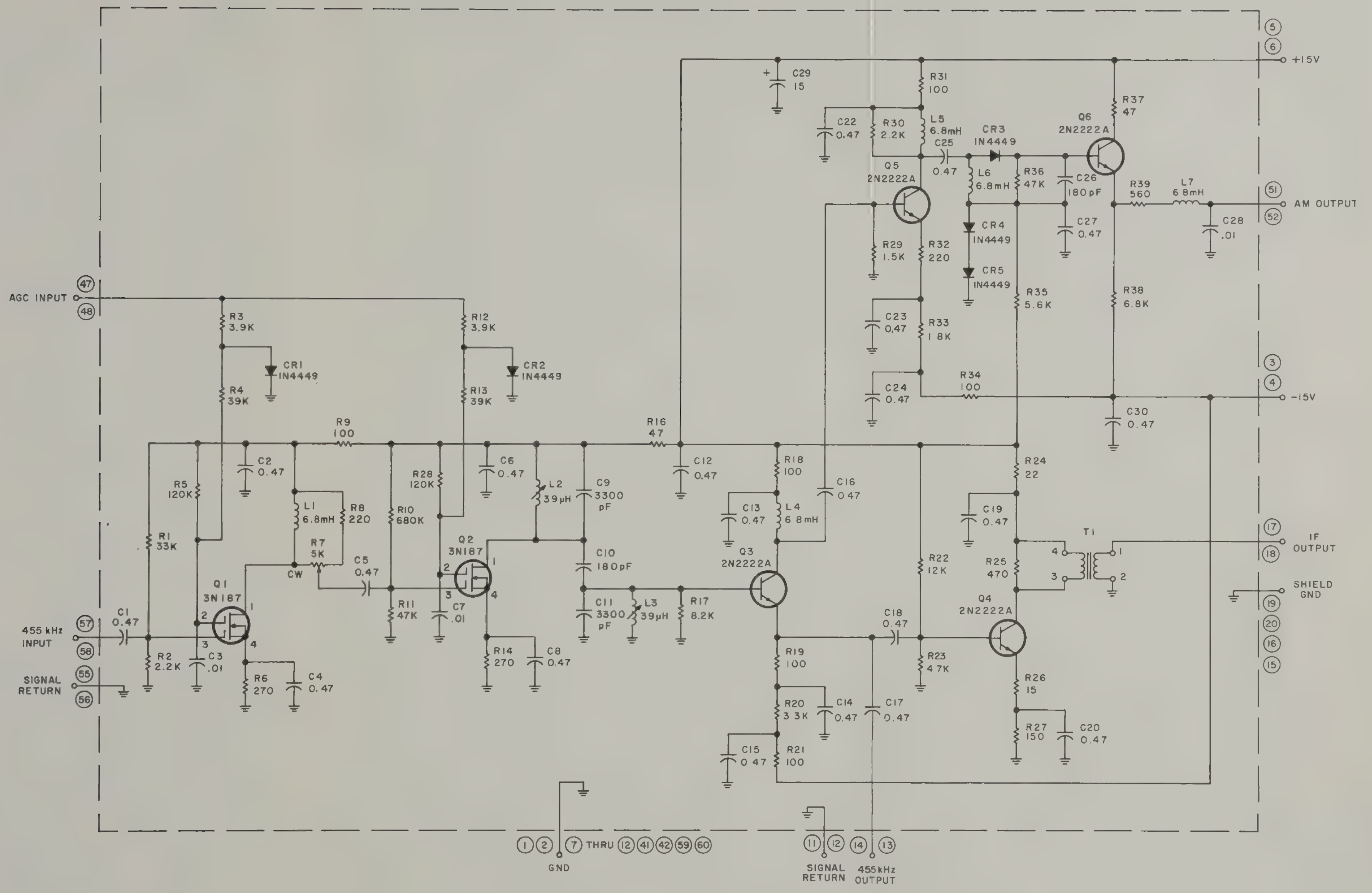

AGC INPUT
㊼
㊽
455 kHz INPUT
(57)
(58)
SIGNAL RETURN
(55)
(56)
C1 0.47
R1 33K
R2 2.2K
R3 3.9K
CR1 1N4449
R4 39K
R5 120K
Q1 3N187
C2 0.47
C3 .01
R6 270
C4 0.47
L1 6.8mH
R8 220
R7 5K
CW
C5 0.47
R9 100
R10 680K
R11 47K
R12 3.9K
CR2 1N4449
R13 39K
R28 120K
Q2 3N187
C6 0.47
C7 .01
R14 270
C8 0.47
L2 39µH
C9 3300 pF
C10 180pF
C11 3300 pF
L3 39µH
R17 8.2K
R16 47
C12 0.47
R18 100
C13 0.47
L4 6.8mH
C16 0.47
Q3 2N2222A
R19 100
R20 3.3K
C14 0.47
C15 0.47
R21 100
C17 0.47
C18 0.47
R22 12K
R23 4.7K
Q4 2N2222A
R24 22
C19 0.47
R25 470
T1
R26 15
R27 150
C20 0.47
C29 15
R31 100
C22 0.47
R30 2.2K
L5 6.8mH
C25 0.47
Q5 2N2222A
R29 1.5K
R32 220
C23 0.47
R33 1.8K
C24 0.47
R34 100
CR3 1N4449
L6 6.8mH
CR4 1N4449
CR5 1N4449
R36 47K
R35 5.6K
C26 180pF
C27 0.47
Q6 2N2222A
R37 47
R39 560
L7 6.8mH
C28 .01
R38 6.8K
C30 0.47
⑤
⑥
+15V
(51)
(52)
AM OUTPUT
③
④
-15V
⑰
⑱
IF OUTPUT
⑲
⑳
⑯
⑮
SHIELD GND
① ② ⑦ THRU ⑫ ㊶ ㊷ (59) (60)
GND
⑪ ⑫ ⑭ ⑬
SIGNAL RETURN
455kHz OUTPUT

Figure 6-9. Type 72488 455 kHz Amplifier/AM Detector (A4A7), Schematic Diagram 51168

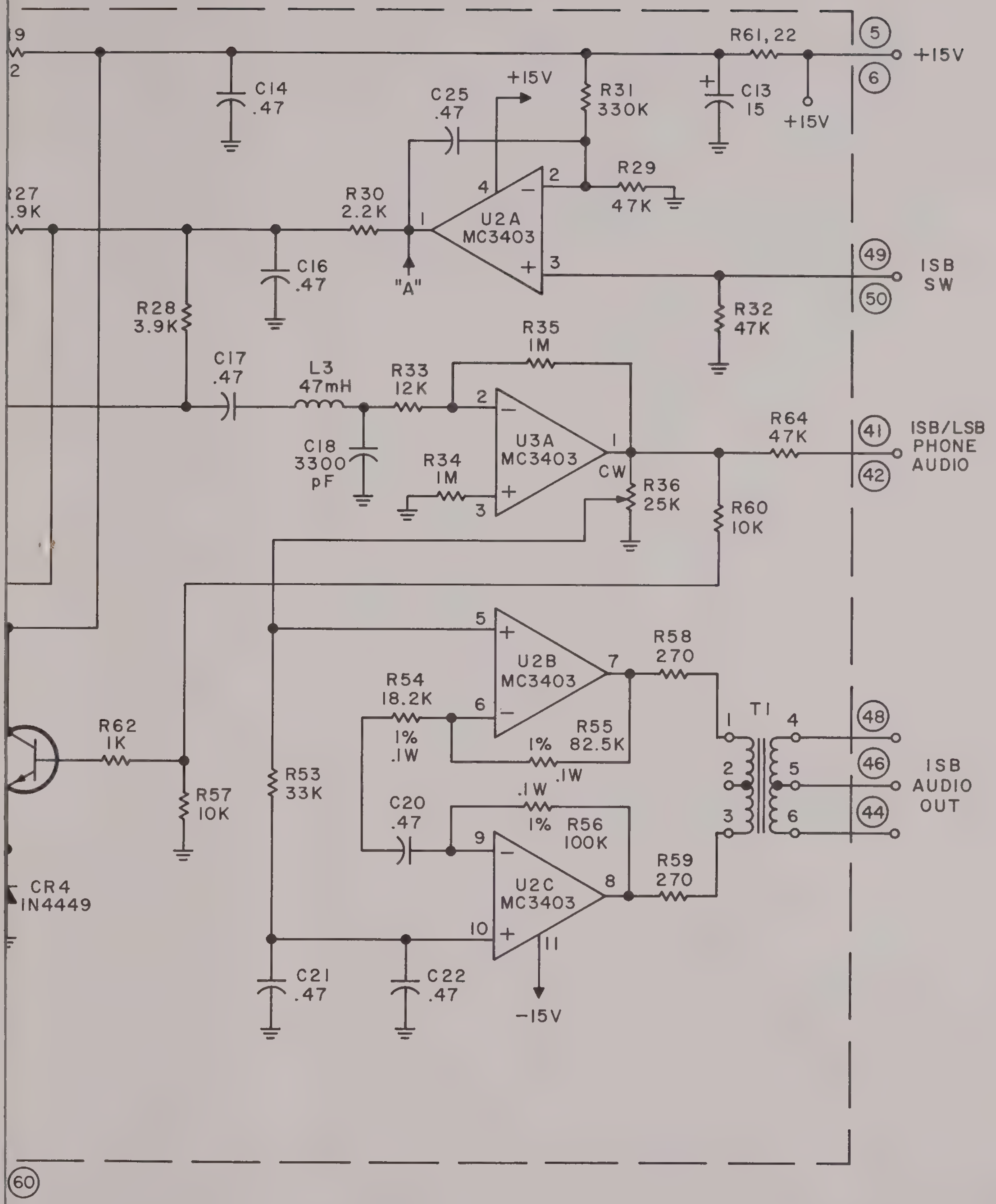
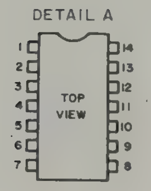

19
2
C14
.47
C25
.47
+15V
R31
330K
R61, 22
C13
15
+15V
+15V
⑤
⑥
R27
.9K
R30
2.2K
U2A
MC3403
R29
47K
C16
.47
"A"
R32
47K
㊾
㊿
ISB
SW
R28
3.9K
C17
.47
L3
47mH
R33
12K
R35
1M
U3A
MC3403
C18
3300
pF
R34
1M
CW
R36
25K
R64
47K
㊶
㊷
ISB/LSB
PHONE
AUDIO
R60
10K
U2B
MC3403
R58
270
R54
18.2K
1%
.1W
R55
82.5K
1%
.1W
T1
㊽
㊻
㊹
ISB
AUDIO
OUT
R62
1K
R57
10K
R53
33K
C20
.47
.1W
1%
R56
100K
U2C
MC3403
R59
270
CR4
1N4449
C21
.47
C22
.47
-15V
(60)

Figure 6-10. Type 791598 ISB Detector/Audio (A4A8), Schematic Diagram 43231


DETAIL A
TOP VIEW
1
2
3
4
5
6
7
14
13
12
11
10
9
8

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.
3. U1, U2, U3 LEAD ARRANGEMENT – DETAIL A

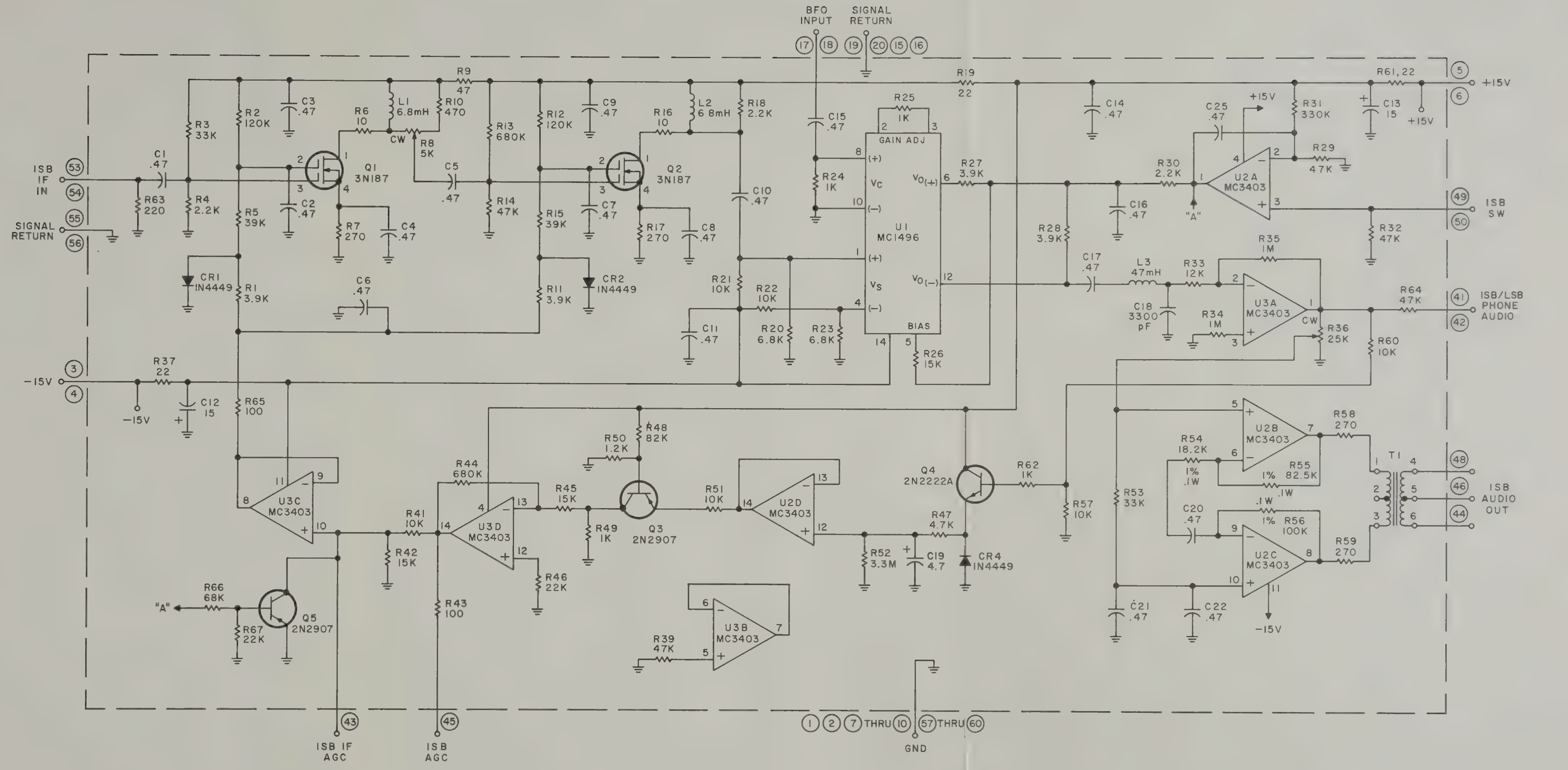
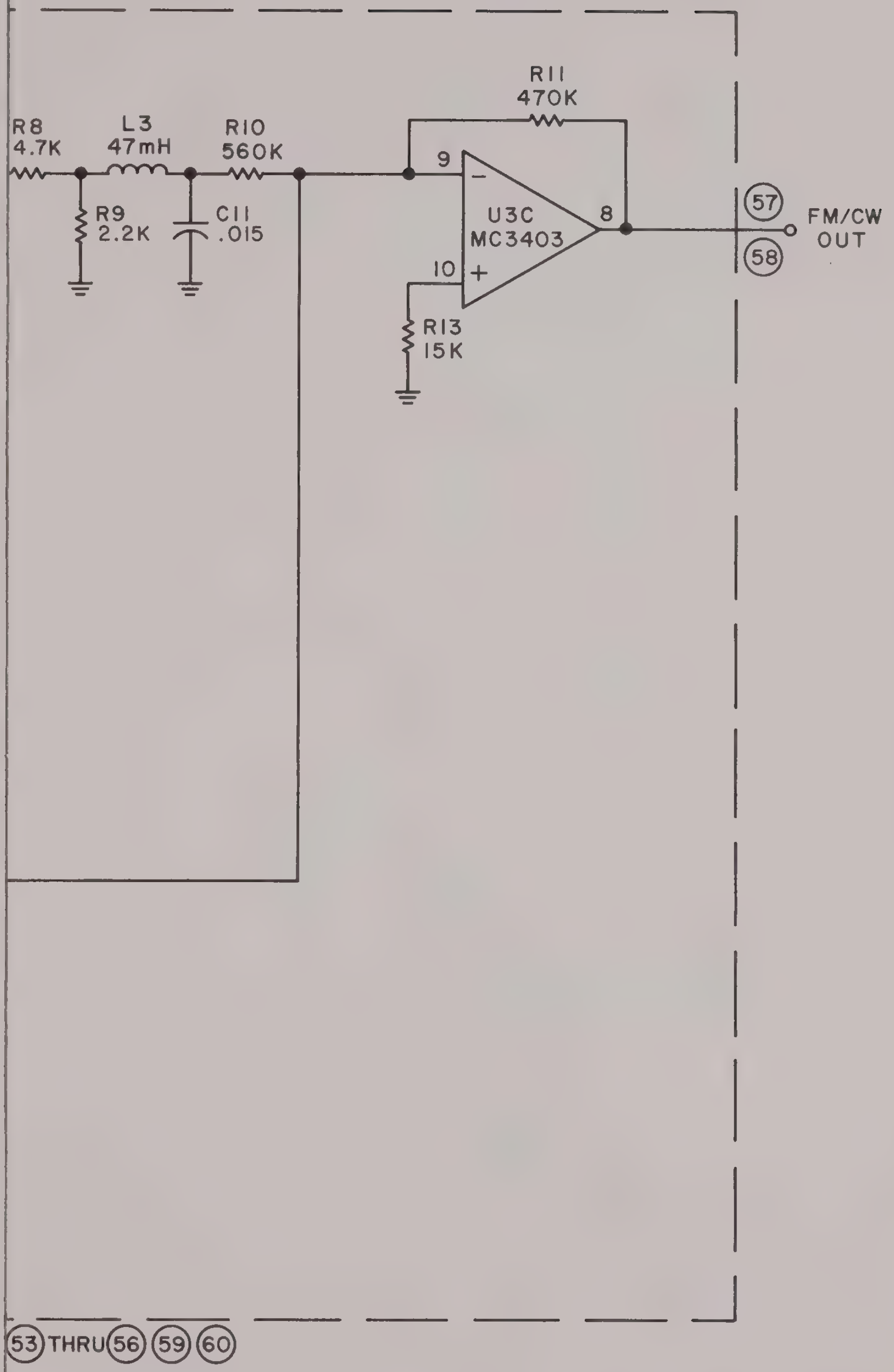
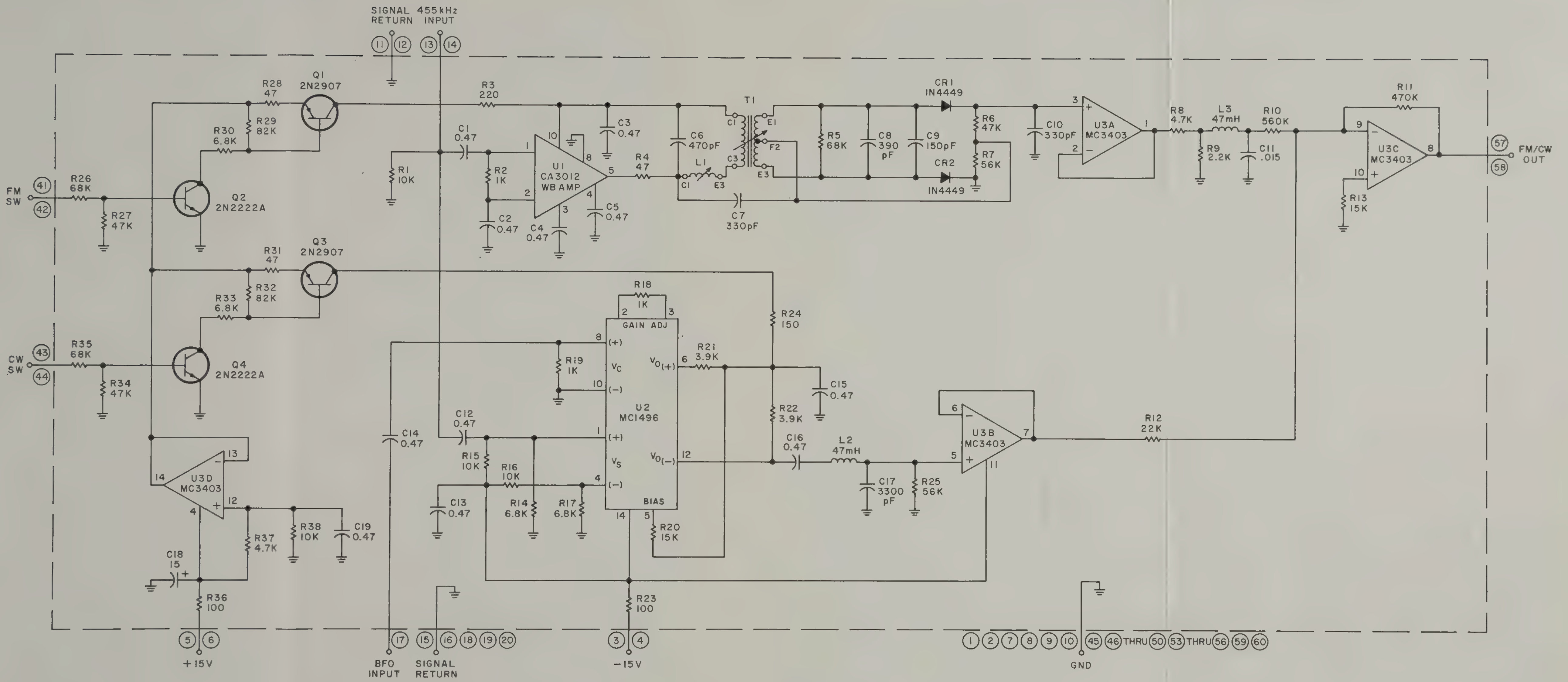

BFO INPUT
SIGNAL RETURN
17
18
19
20
15
16
ISB IF IN
53
54
SIGNAL RETURN
55
56
C1 .47
R63 220
R3 33K
R4 2.2K
R2 120K
R5 39K
C3 .47
C2 .47
CR1 1N4449
R1 3.9K
R6 10
Q1 3N187
R7 270
C4 .47
L1 6.8mH
CW
R8 5K
R9 47
R10 470
C5 .47
C6 .47
R13 680K
R14 47K
R12 120K
R15 39K
R11 3.9K
CR2 1N4449
C9 .47
C7 .47
R16 10
Q2 3N187
R17 270
C8 .47
L2 6.8mH
R18 2.2K
C10 .47
R21 10K
C11 .47
R22 10K
R20 6.8K
R23 6.8K
C15 .47
R24 1K
R25 1K
GAIN ADJ
U1 MC1496
VC
VS
VO(+)
VO(–)
BIAS
R26 15K
R27 3.9K
R19 22
C14 .47
R28 3.9K
C16 .47
R30 2.2K
"A"
C25 .47
+15V
U2A MC3403
R31 330K
R29 47K
R61, 22
C13 15
+15V
5
6
+15V
49
50
ISB SW
R32 47K
C17 .47
L3 47mH
R33 12K
C18 3300 pF
R34 1M
R35 1M
U3A MC3403
R36 25K
R64 47K
41
42
ISB/LSB PHONE AUDIO
R60 10K
-15V
3
4
R37 22
C12 15
-15V
R65 100
U3C MC3403
R66 68K
"A"
R67 22K
Q5 2N2907
R41 10K
R42 15K
R44 680K
U3D MC3403
R43 100
R45 15K
R46 22K
R48 82K
R50 1.2K
Q3 2N2907
R49 1K
R51 10K
U2D MC3403
U3B MC3403
R39 47K
R52 3.3M
C19 4.7
R47 4.7K
CR4 1N4449
Q4 2N2222A
R62 1K
R57 10K
R53 33K
R54 18.2K 1% .1W
U2B MC3403
R55 82.5K 1% .1W
R58 270
T1
48
46
44
ISB AUDIO OUT
C20 .47
R56 100K 1% .1W
U2C MC3403
R59 270
C21 .47
C22 .47
-15V
43
ISB IF AGC
45
ISB AGC
1
2
7 THRU 10
57 THRU 60
GND

Figure 6-10. Type 791598 ISB Detector/Audio (A4A8), Schematic Diagram 43231


R11
470K
R8
4.7K
L3
47mH
R10
560K
9
8
10
U3C
MC3403
R9
2.2K
C11
.015
R13
15K
57
58
FM/CW
OUT
53
THRU
56
59
60

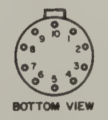
-11. Type 791599 FM, CW, and SSB Detector (A4A9), Schematic Diagram 43198


SIGNAL RETURN
455kHz INPUT
⑪ ⑫ ⑬ ⑭
R28 47
Q1 2N2907
R29 82K
R30 6.8K
R3 220
C1 0.47
R1 10K
R2 1K
C2 0.47
U1 CA3012 WB AMP
C4 0.47
C3 0.47
C5 0.47
R4 47
C6 470pF
L1
T1
C7 330pF
R5 68K
C8 390 pF
C9 150pF
CR1 1N4449
CR2 1N4449
R6 47K
R7 56K
C10 330pF
U3A MC3403
R8 4.7K
R9 2.2K
L3 47mH
C11 .015
R10 560K
R11 470K
U3C MC3403
R13 15K
FM/CW OUT
57
58
FM SW
41
42
R26 68K
R27 47K
Q2 2N2222A
R31 47
Q3 2N2907
R32 82K
R33 6.8K
CW SW
43
44
R35 68K
R34 47K
Q4 2N2222A
R18 1K
GAIN ADJ
U2 MC1496
R19 1K
BIAS
R21 3.9K
R24 150
C15 0.47
R22 3.9K
C16 0.47
L2 47mH
C17 3300 pF
R25 56K
U3B MC3403
R12 22K
C14 0.47
C12 0.47
R15 10K
R16 10K
C13 0.47
R14 6.8K
R17 6.8K
R20 15K
U3D MC3403
R37 4.7K
R38 10K
C19 0.47
C18 15
R36 100
R23 100
⑤ ⑥
+15V
⑰
BFO INPUT
⑮ ⑯ ⑱ ⑲ ⑳
SIGNAL RETURN
③ ④
−15V
① ② ⑦ ⑧ ⑨ ⑩ ㊺ ㊻ THRU ㊿ (53) THRU (56) (59) (60)
GND

NOTES:

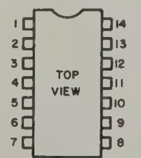
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.
3. LEAD ARRANGEMENT OF IC's — DETAILS A, B.

DETAIL A


1
2
3
4
5
6
7
8
9
10
BOTTOM VIEW

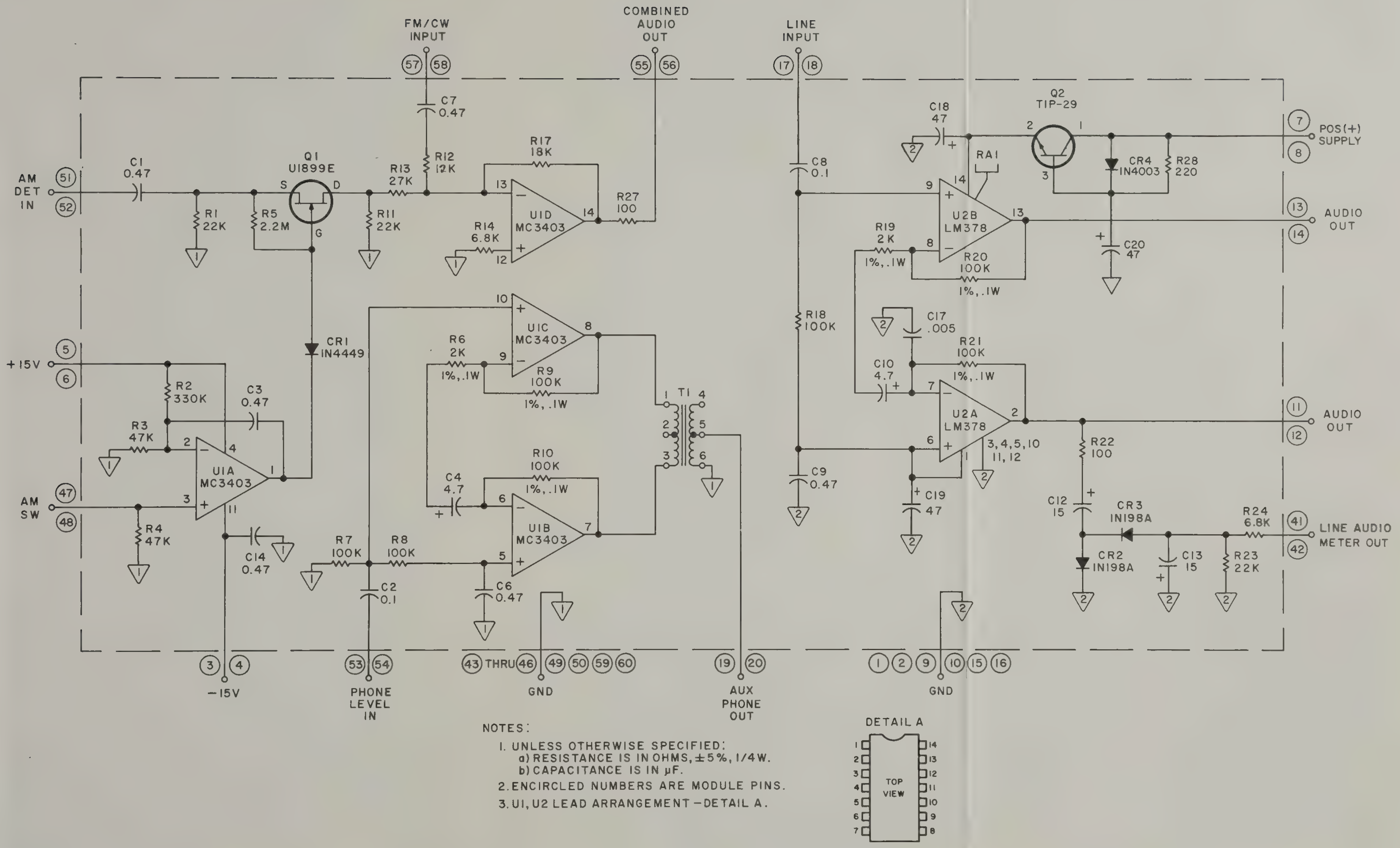
U1

DETAIL B


1
2
3
4
5
6
7
14
13
12
11
10
9
8
TOP VIEW

U2, U3

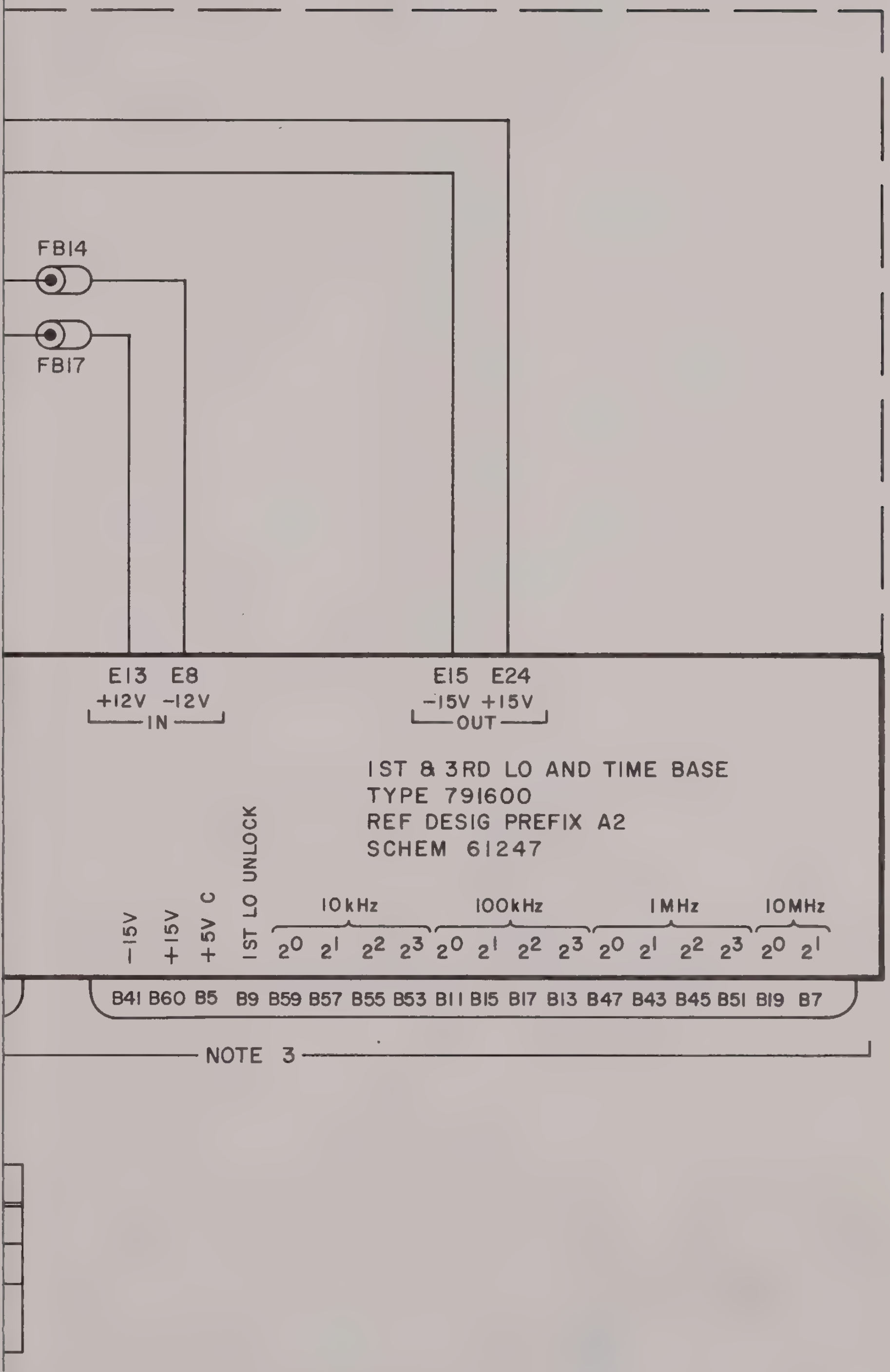
Figure 6-11. Type 791599 FM, CW, and SSB Detector (A4A9), Schematic Diagram 43198


FM/CW INPUT
COMBINED AUDIO OUT
LINE INPUT
AM DET IN
+15V
AM SW
-15V
PHONE LEVEL IN
GND
AUX PHONE OUT
GND
POS(+) SUPPLY
AUDIO OUT
AUDIO OUT
LINE AUDIO METER OUT
C1 0.47
R1 22K
R5 2.2M
Q1 U1899E
S D G
R11 22K
R13 27K
R12 12K
C7 0.47
R17 18K
R14 6.8K
U1D MC3403
R27 100
CR1 1N4449
R2 330K
R3 47K
C3 0.47
U1A MC3403
R4 47K
C14 0.47
U1C MC3403
R6 2K 1%, .1W
R9 100K 1%, .1W
R10 100K 1%, .1W
C4 4.7
U1B MC3403
R7 100K
R8 100K
C2 0.1
C6 0.47
T1
C8 0.1
R18 100K
C9 0.47
C18 47
Q2 TIP-29
RA1
CR4 1N4003
R28 220
U2B LM378
R19 2K 1%, .1W
R20 100K 1%, .1W
C20 47
C17 .005
C10 4.7
R21 100K 1%, .1W
U2A LM378
3, 4, 5, 10 11, 12
C19 47
R22 100
C12 15
CR3 1N198A
CR2 1N198A
C13 15
R24 6.8K
R23 22K
⑤① ⑤② ⑤⑦ ⑤⑧ ⑤⑤ ⑤⑥ ⑰ ⑱ ⑦ ⑧ ⑬ ⑭ ⑪ ⑫ ④① ④② ⑤ ⑥ ④⑦ ④⑧ ③ ④ ⑤③ ⑤④ ④③ THRU ④⑥ ④⑨ ⑤⓪ ⑤⑨ ⑥⓪ ⑲ ⑳ ① ② ⑨ ⑩ ⑮ ⑯
DETAIL A
TOP VIEW

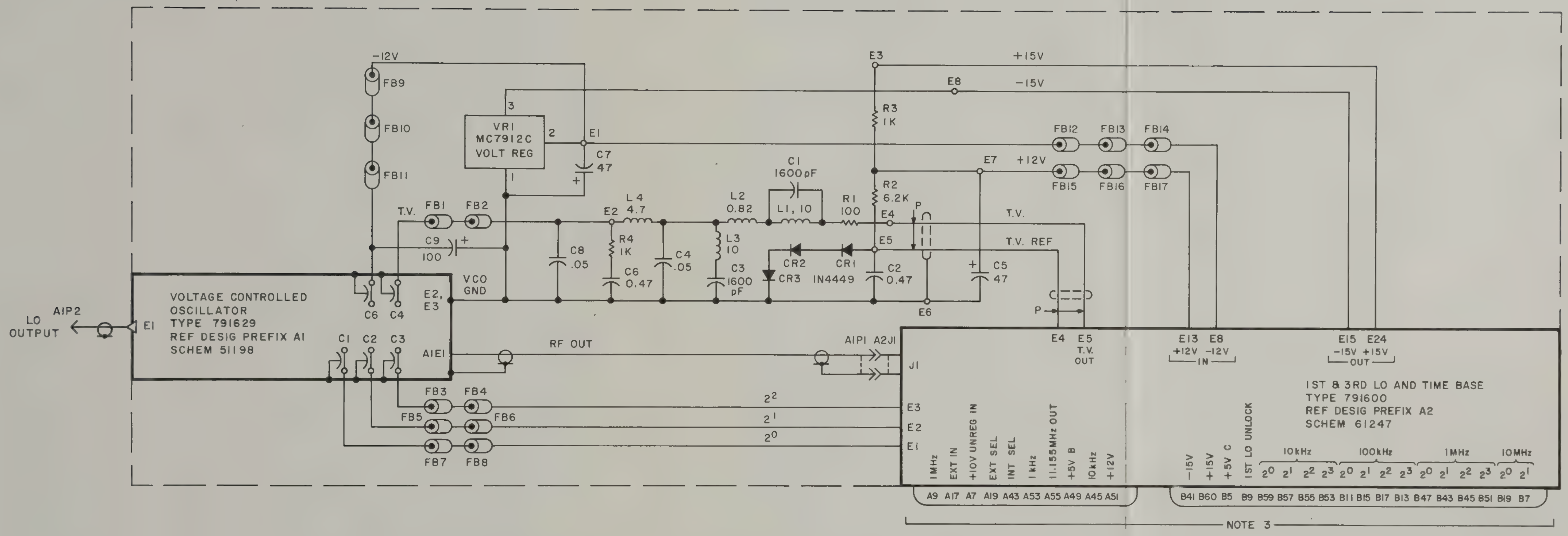
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PINS.
3. U1, U2 LEAD ARRANGEMENT – DETAIL A.

Figure 6-12. Type 7459 Audio Amplifier (A4A10), Schematic Diagram 43230


FB14
FB17
E13 E8
+12V -12V
IN
E15 E24
-15V +15V
OUT
1ST & 3RD LO AND TIME BASE
TYPE 791600
REF DESIG PREFIX A2
SCHEM 61247
-15V
+15V
+5V C
1ST LO UNLOCK
10kHz
100kHz
1MHz
10MHz
2^0 2^1 2^2 2^3 2^0 2^1 2^2 2^3 2^0 2^1 2^2 2^3 2^0 2^1
B41 B60 B5 B9 B59 B57 B55 B53 B11 B15 B17 B13 B47 B43 B45 B51 B19 B7
NOTE 3

791630 1st and 3rd LO Synthesizer/Time Base (A5A1),
matic Diagram 43305


-12V
FB9
FB10
FB11
VR1
MC7912C
VOLT REG
3
2
1
E1
C7
47
+
T.V.
FB1
FB2
C9
100
L4
4.7
E2
R4
1K
C6
0.47
C8
.05
C4
.05
L2
0.82
L3
10
C3
1600
pF
C1
1600pF
L1, 10
R1
100
CR2
CR1
CR3
IN4449
E3
+15V
E8
-15V
R3
1K
R2
6.2K
E4
E5
P
C2
0.47
E6
E7
+12V
C5
47
FB12
FB13
FB14
FB15
FB16
FB17
T.V.
T.V. REF
VOLTAGE CONTROLLED
OSCILLATOR
TYPE 791629
REF DESIG PREFIX A1
SCHEM 51198
C6
C4
C1
C2
C3
E2,
E3
VCO
GND
A1E1
A1P2
LO
OUTPUT
E1
RF OUT
A1P1
A2J1
J1
FB3
FB4
FB5
FB6
FB7
FB8
2^2
2^1
2^0
E3
E2
E1
E4
E5
T.V.
OUT
E13
+12V
E8
-12V
IN
E15
-15V
E24
+15V
OUT
1ST & 3RD LO AND TIME BASE
TYPE 791600
REF DESIG PREFIX A2
SCHEM 61247
1MHz
EXT IN
+10V UNREG IN
EXT SEL
INT SEL
1kHz
11.155MHz OUT
+5V B
10kHz
+12V
-15V
+15V
+5V C
1ST LO UNLOCK
10kHz
100kHz
1MHz
10MHz
2^0 2^1 2^2 2^3
A9 A17 A7 A19 A43 A53 A55 A49 A45 A51
B41 B60 B5 B9 B59 B57 B55 B53 B11 B15 B17 B13 B47 B43 B45 B51 B19 B7
NOTE 3

NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ± 5%, 1/4W
   b) CAPACITANCE IS IN μF.
   c) INDUCTANCE IS IN mH.
2. LEAD ARRANGEMENT FOR VR1 IS SHOWN IN DETAIL A.
3. LETTERS (NUMBERS) ARE MODULE (A2) PINS. GND PINS FOR GND_1, GND_2, GND_3, ARE LISTED IN TABLE A.

DETAIL A

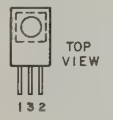

TOP
VIEW
1 3 2

TABLE A

GND	MODULE PIN
GND_1	A48, 50, 52, 54, 56, 58, 60
GND_2	A2, 4, 6, 8, 10, 14, 16, 18, 20, 42, 44, 46
GND_3	B2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 42, 44, 46, 48, 50, 52, 54, 56, 58

Figure 6-13. Type 791630 1st and 3rd LO Synthesizer/Time Base (A5A1), Schematic Diagram 43305

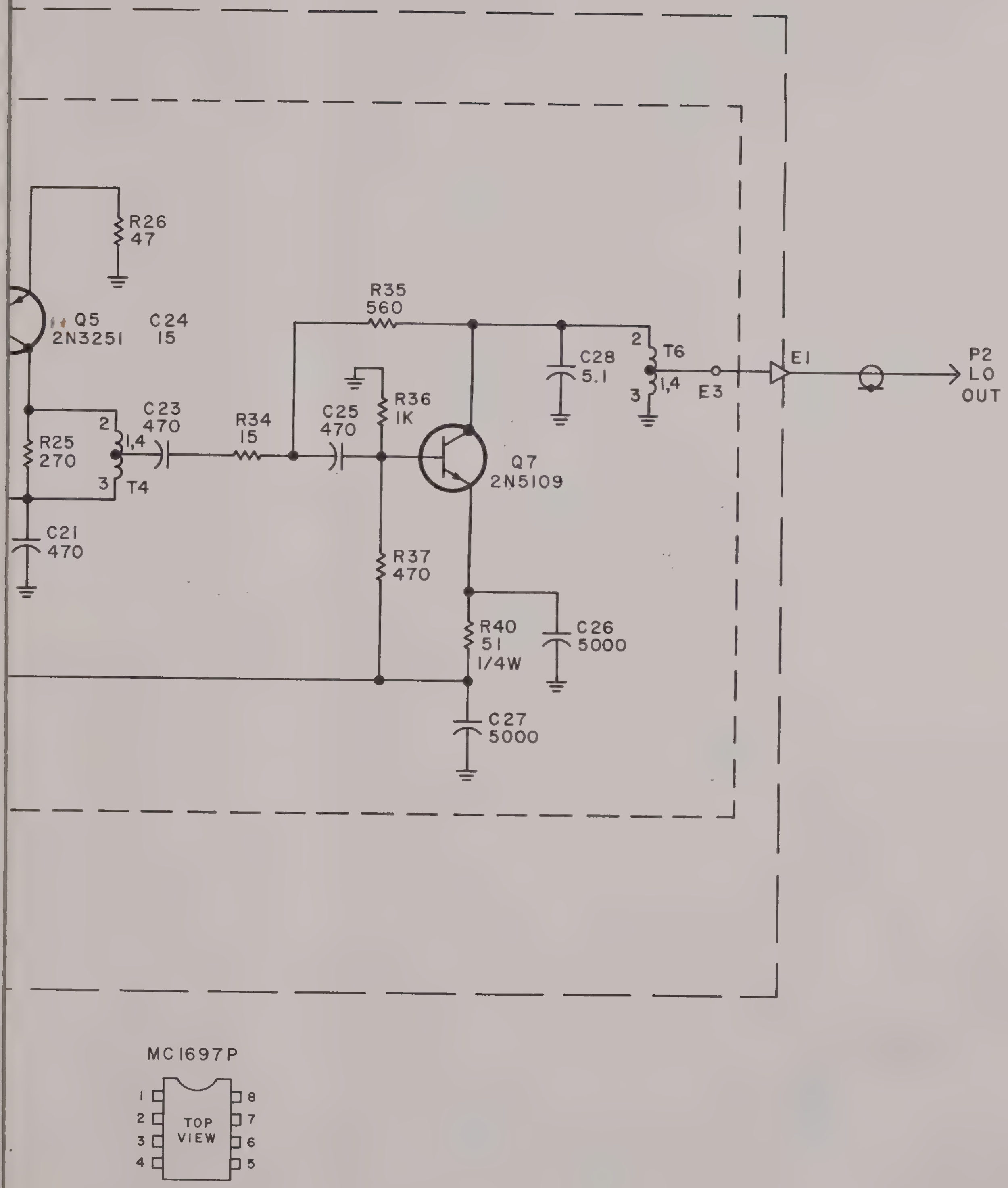
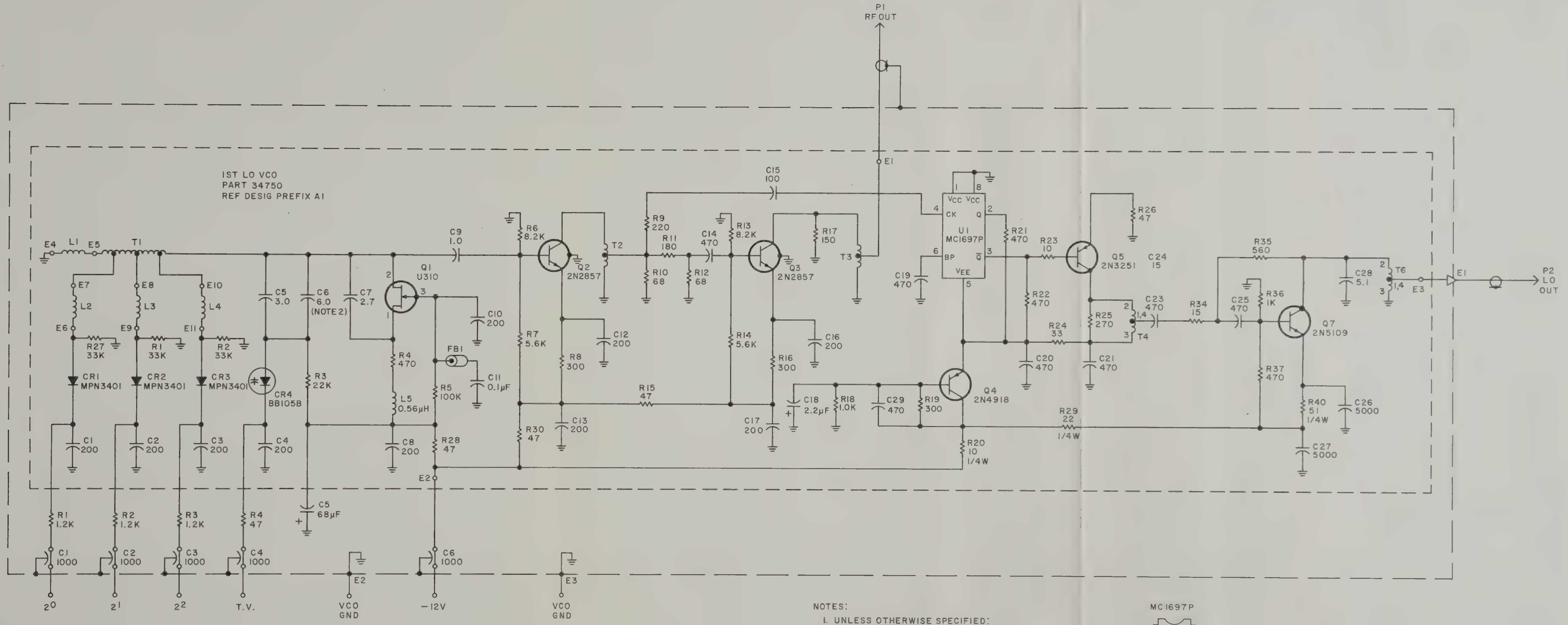

R26
47
Q5
2N3251
C24
15
R35
560
C28
5.1
2
T6
3
1,4
E3
E1
P2
LO
OUT
R36
1K
C25
470
R34
15
C23
470
2
1,4
3
T4
R25
270
C21
470
Q7
2N5109
R37
470
R40
51
1/4W
C26
5000
C27
5000
MC1697P
1
2
3
4
TOP
VIEW
8
7
6
5

Figure 6-14. Type 791629 Voltage Controlled Oscillator (A5A1A1), Schematic Diagram 51198


P1
RF OUT
E1
IST LO VCO
PART 34750
REF DESIG PREFIX A1
E4 L1 E5 T1
E7 E8 E10
L2 L3 L4
E6 E9 E11
R27 33K
R1 33K
R2 33K
CR1 MPN3401
CR2 MPN3401
CR3 MPN3401
CR4 BB105B
C5 3.0
C6 6.0 (NOTE 2)
C7 2.7
R3 22K
C1 200
C2 200
C3 200
C4 200
Q1 U310
R4 470
L5 0.56μH
C8 200
FB1
C10 200
C11 0.1μF
R5 100K
R28 47
C9 1.0
R6 8.2K
R7 5.6K
R30 47
Q2 2N2857
T2
C12 200
R8 300
C13 200
R15 47
C15 100
R9 220
R11 180
R10 68
R12 68
C14 470
R13 8.2K
R14 5.6K
Q3 2N2857
R17 150
T3
C16 200
R16 300
C17 200
C18 2.2μF
R18 1.0K
C29 470
R19 300
Q4 2N4918
R20 10 1/4W
U1 MC1697P
Vcc Vcc
CK Q
BP Q̄
VEE
C19 470
R21 470
R22 470
R23 10
R24 33
C20 470
Q5 2N3251
R26 47
C24 15
R25 270
C21 470
T4
C23 470
R34 15
C25 470
R35 560
R36 1K
Q7 2N5109
R37 470
R40 51 1/4W
C26 5000
C27 5000
R29 22 1/4W
C28 5.1
T6
E3
E1
P2 LO OUT
E2
R1 1.2K
R2 1.2K
R3 1.2K
R4 47
C5 68μF
C1 1000
C2 1000
C3 1000
C4 1000
C6 1000
E2
E3
2⁰
2¹
2²
T.V.
VCO GND
−12V
VCO GND

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ± 5%, 1/8W.
   b) CAPACITANCE IS IN pF.
2. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.

MC1697P

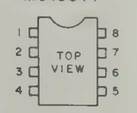
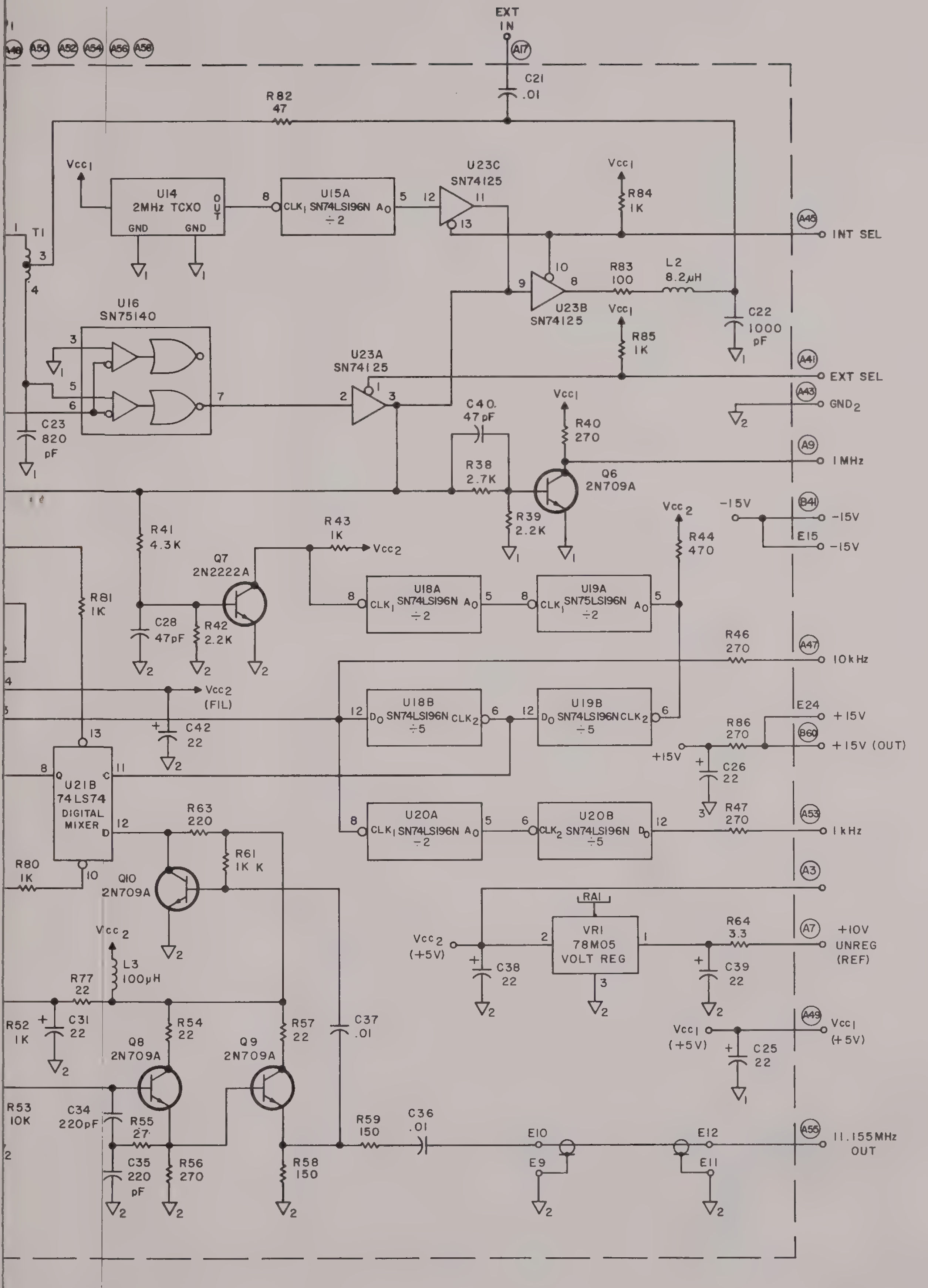

1
2
3
4
8
7
6
5
TOP VIEW

Figure 6-14. Type 791629 Voltage Controlled Oscillator (A5A1A1), Schematic Diagram 51198


EXT IN
A17
C21 .01
R82 47
U14 2MHz TCXO
OUT
GND
U15A SN74LS196N CLK1 A0 ÷2
U23C SN74125
Vcc1
R84 1K
A45 INT SEL
T1
U16 SN75140
R83 100
L2 8.2μH
U23B SN74125
C22 1000 pF
R85 1K
U23A SN74125
A41 EXT SEL
A43 GND2
C23 820 pF
C40 47pF
R40 270
A9 1MHz
R38 2.7K
Q6 2N709A
R39 2.2K
-15V
B41 -15V
E15 -15V
R44 470
Vcc2
R41 4.3K
R43 1K
Q7 2N2222A
U18A SN74LS196N CLK1 A0 ÷2
U19A SN75LS196N CLK1 A0 ÷2
R81 1K
C28 47pF
R42 2.2K
R46 270
A47 10kHz
Vcc2 (FIL)
U18B SN74LS196N D0 CLK2 ÷5
U19B SN74LS196N D0 CLK2 ÷5
C42 22
E24 +15V
R86 270
B60 +15V (OUT)
+15V
C26 22
U21B 74LS74 DIGITAL MIXER
U20A SN74LS196N CLK1 A0 ÷2
U20B SN74LS196N CLK2 D0 ÷5
R47 270
A53 1kHz
R63 220
R61 1K K
R80 1K
Q10 2N709A
A3
RA1
VR1 78M05 VOLT REG
R64 3.3
A7 +10V UNREG (REF)
Vcc2 (+5V)
C38 22
C39 22
L3 100μH
R77 22
C31 22
R52 1K
R54 22
R57 22
C37 .01
Q8 2N709A
Q9 2N709A
Vcc1 (+5V)
C25 22
A49 Vcc1 (+5V)
R53 10K
C34 220pF
R55 27
C35 220 pF
R56 270
R58 150
R59 150
C36 .01
E10
E9
E12
E11
A55 11.155MHz OUT

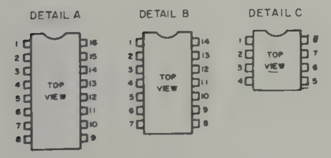
ure 6-15. Type 791600 1st and 3rd LO Synthesizer/Time Base (A5A1A2), Schematic Diagram 61247

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS (LETTERS) ARE MODULE PIN CONNECTIONS.
3. Vcc, GND PINS, AND LEAD ARRANGEMENTS FOR IC'S ARE LISTED IN TABLE A.
4. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED

TABLE A

IC	REF DESIG	Vcc 1	Vcc 2	Vcc 3	GND 1	GND 2	GND 3	DTL	Vcc2 (FIL)
MC4044P	U5			14			7	B	
MC4044P	U22					7		B	14
MC12013L	U1			16			8	A	
MC12014L	U3			16			8	A	
MC74417P	U9			16			8	A	
SN74S196	U2			14			7	B	
SN74LS00	U6			14			7	B	
74185	U4			16			8	A	
SN74LS190	U8, U10			16			8	A	
SN74LS191	U11			16			8	A	
SN74184	U13			16			8	A	
SN75140	U16	8			4			C	
74LS74	U21					7		B	14
8292	U15, U17	14			7			B	
8292	U18, U20		14			7		B	
741	U7							C	
SN74LS74	U12			14			7	B	
SN74125	U23	14			7			B	


DETAIL A
DETAIL B
DETAIL C
TOP VIEW
TOP VIEW
TOP VIEW

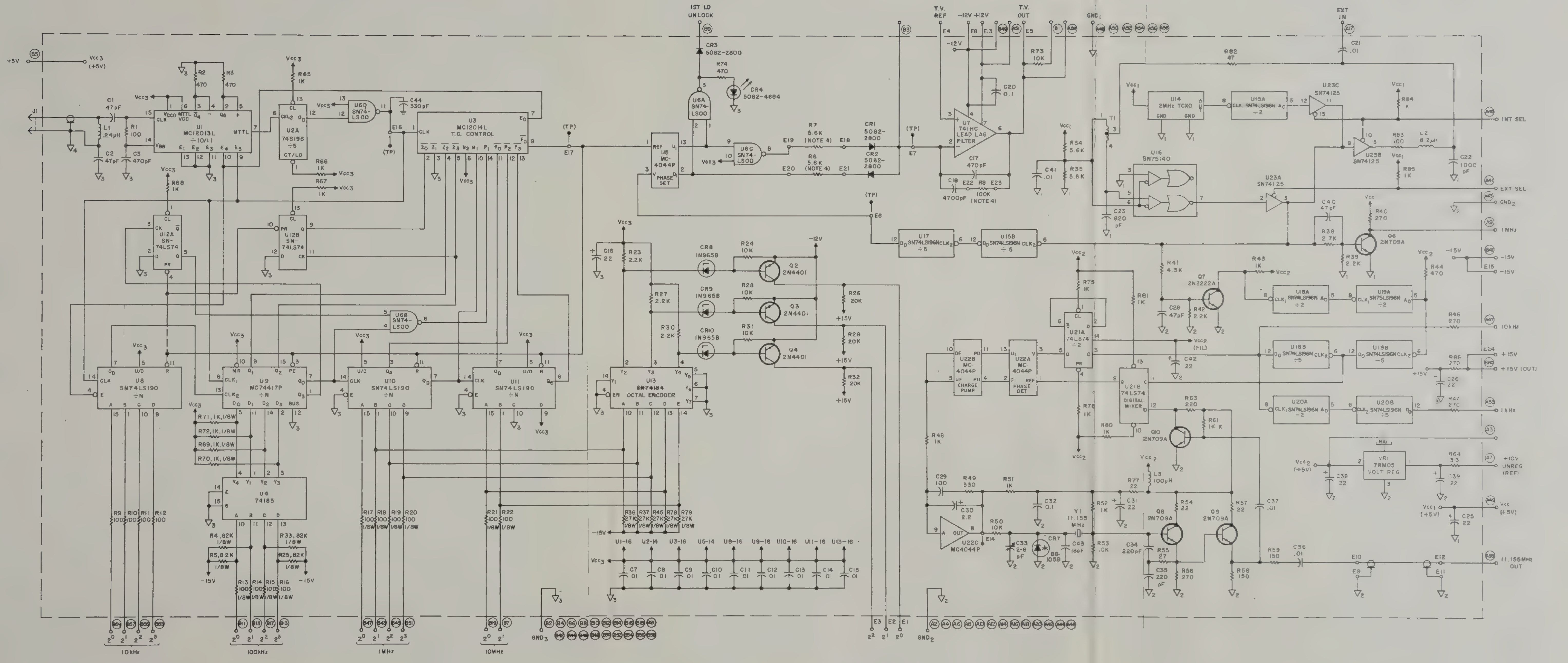

+5V
Vcc3 (+5V)
J1
C1 47pF
L1 .24μH
R1 100
C2 47pF
C3 470pF
U1 MC12013L ÷10/11
R2 470
R3 470
U2A 74S196 ÷5
R65 1K
U6D SN74LS00
C44 330pF
E16 (TP)
U3 MC12014L T.C. CONTROL
(TP) E17
R66 1K
R67 1K
R68 1K
U12A SN74LS74
U12B SN74LS74
U6B SN74LS00
U8 SN74LS190 ÷N
U9 MC74417P ÷N
U10 SN74LS190 ÷N
U11 SN74LS190 ÷N
U4 74185
R71,1K,1/8W
R72,1K,1/8W
R69,1K,1/8W
R70,1K,1/8W
R4,82K 1/8W
R5,82K 1/8W
R33,82K 1/8W
R25,82K 1/8W
-15V
R9 100
R10 100
R11 100
R12 100
R13 100 1/8W
R14 100 1/8W
R15 100 1/8W
R16 100 1/8W
R17 100 1/8W
R18 100 1/8W
R19 100 1/8W
R20 100 1/8W
R21 100 1/8W
R22 100 1/8W
10kHz
100kHz
1MHz
10MHz
GND3
1ST LO UNLOCK
CR3 5082-2800
R74 470
CR4 5082-4684
U6A SN74LS00
U5 MC4044P PHASE DET
U6C SN74LS00
R7 5.6K (NOTE 4)
R6 5.6K (NOTE 4)
E19
E18
E20
E21
CR1 5082-2800
CR2 5082-2800
(TP) E7
(TP) E6
C16 22
R23 2.2K
R27 2.2K
R30 2.2K
CR8 1N965B
CR9 1N965B
CR10 1N965B
R24 10K
R28 10K
R31 10K
Q2 2N4401
Q3 2N4401
Q4 2N4401
-12V
R26 20K
R29 20K
R32 20K
+15V
U13 SN74184 OCTAL ENCODER
R36 27K 1/8W
R37 27K 1/8W
R45 27K 1/8W
R78 27K 1/8W
R79 27K 1/8W
C7 .01
C8 .01
C9 .01
C10 .01
C11 .01
C12 .01
C13 .01
C14 .01
C15 .01
E3
E2
E1
T.V. REF
-12V +12V
T.V. OUT
E4
E8
E13
E5
R73 10K
C20 0.1
U7 741HC LEAD LAG FILTER
C17 470pF
C18 4700pF
E22
R8 100K (NOTE 4)
E23
U17 SN74LS196N ÷5
U15B SN74LS196N ÷5
R34 5.6K
R35 5.6K
C41 .01
GND1
U14 2MHz TCXO
U15A SN74LS196N ÷2
U16 SN75140
T1
C23 820 pF
U23A SN74125
U23B SN74125
U23C SN74125
EXT IN
C21 .01
R82 47
R84 1K
R83 100
L2 8.2μH
C22 1000 pF
R85 1K
INT SEL
EXT SEL
GND2
1MHz
C40 47pF
R38 2.7K
R39 2.2K
R40 270
Q6 2N709A
R41 4.3K
Q7 2N2222A
C28 47pF
R42 2.2K
R43 1K
U18A SN74LS196N ÷2
U19A SN74LS196N ÷2
R44 470
-15V
E15
R46 270
10kHz
U18B SN74LS196N ÷5
U19B SN74LS196N ÷5
R86 270
E24
+15V
+15V (OUT)
C26 22
R47 270
U20A SN74LS196N ÷2
U20B SN74LS196N ÷5
1kHz
R75 1K
R81 1K
U21A 74LS74 ÷2
U21B 74LS74 DIGITAL MIXER
Vcc2 (FIL)
C42 22
U22B MC4044P CHARGE PUMP
U22A MC4044P PHASE DET
R76 1K
R80 1K
R63 220
R61 1K
Q10 2N709A
R48 1K
L3 100μH
R77 22
VR1 78M05 VOLT REG
C38 22
C39 22
R64 3.3
+10V UNREG (REF)
C25 22
Vcc (+5V)
C29 100
R49 330
R51 1K
C30 2.2
R50 10K
E14
U22C MC4044P
C33 2-8 pF
CR7 BB-105B
C32 0.1
Y1 11.155 MHz
C43 18pF
R52 1K
R53 10K
C31 22
C34 220pF
Q8 2N709A
R54 22
R55 27
C35 220 pF
R56 270
Q9 2N709A
R57 22
R58 150
C37 .01
R59 150
C36 .01
E10
E9
E12
E11
11.155MHz OUT
GND2

Figure 6-15. Type 791600 1st and 3rd LO Synthesizer/Time Base (A5A1A2), Schematic Diagram 61247

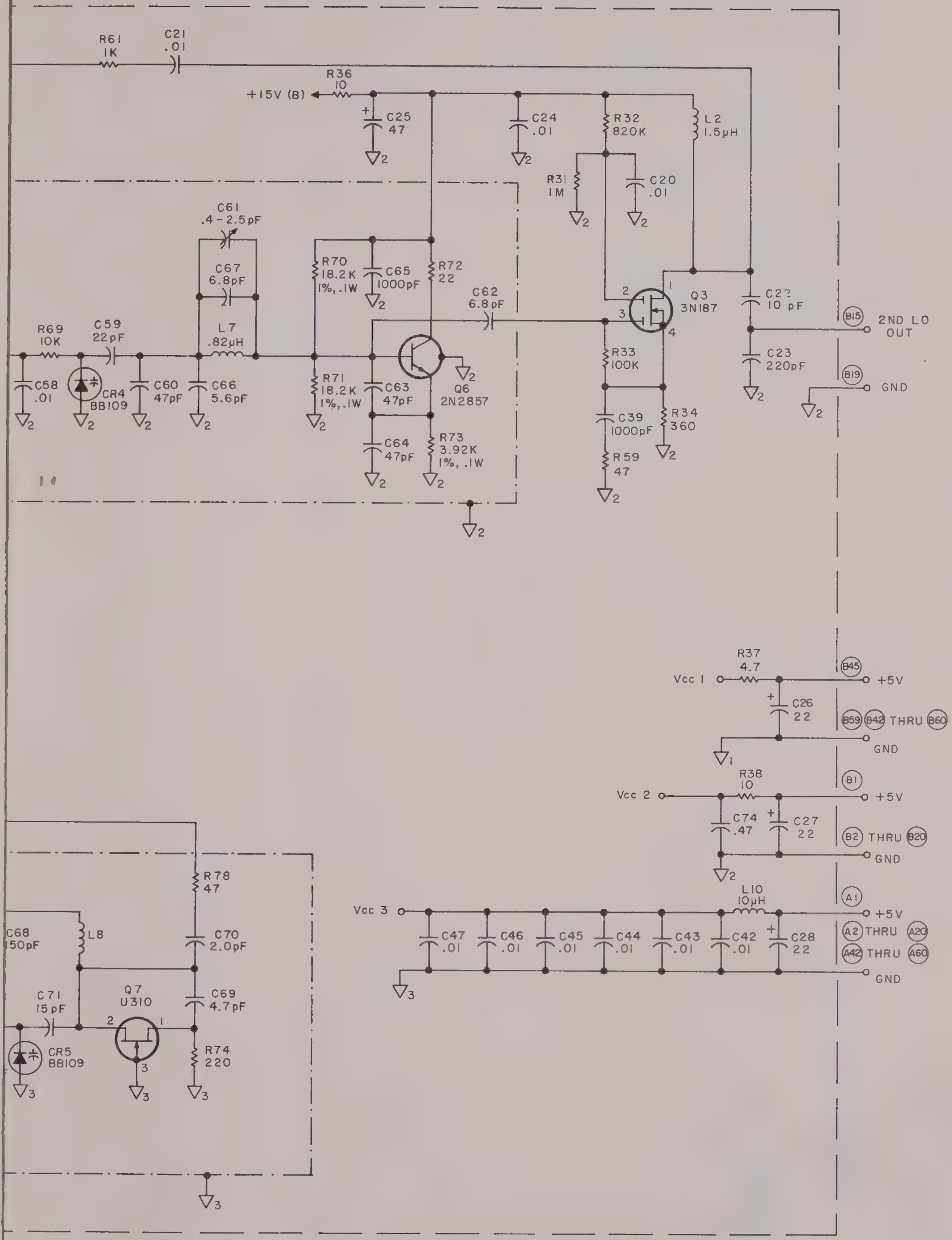
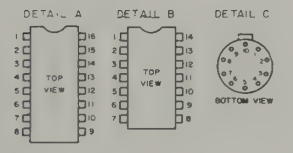

R61
1K
C21
.01
R36
10
+15V (B)
C25
47
C24
.01
R32
820K
L2
1.5μH
R31
1M
C20
.01
C61
.4 - 2.5pF
C67
6.8pF
L7
.82μH
R70
18.2K
1%, .1W
C65
1000pF
R72
22
C62
6.8pF
Q3
3N187
C22
10 pF
C23
220pF
B15
2ND LO
OUT
B19
GND
R69
10K
C59
22pF
C58
.01
CR4
BB109
C60
47pF
C66
5.6pF
R71
18.2K
1%, .1W
C63
47pF
Q6
2N2857
R33
100K
C39
1000pF
R34
360
R59
47
C64
47pF
R73
3.92K
1%, .1W
R37
4.7
Vcc 1
B45
+5V
C26
22
B59 B42 THRU B60
GND
R38
10
Vcc 2
B1
+5V
C74
.47
C27
22
B2 THRU B20
GND
L10
10μH
Vcc 3
A1
+5V
C47
.01
C46
.01
C45
.01
C44
.01
C43
.01
C42
.01
C28
22
A2 THRU A20
A42 THRU A60
GND
R78
47
C68
150pF
L8
C70
2.0pF
C71
15pF
Q7
U310
C69
4.7pF
CR5
BB109
R74
220

Figure 6-16. Type 791601 2nd LO Synthesizer (A5A2), Schematic Diagram 61256

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS IN μF.
2. PIN ARRANGEMENTS AND POWER CONNECTIONS FOR ICs ARE GIVEN IN TABLE 1.

TABLE 1

IC TYPE	REF DESIG	DETAIL	Vcc PIN	Vcc 2 PIN	Vcc 3 PIN	▽1	▽2	▽3
MC4044	U1	B	14			7		
828	U2	B	14			7		
74S74	U3	B	14			7		
796	U4	C						
733	U5	C						
MC4044	U6	B		14			7	
74LS90	U7, U8	A			16			8
74LS191	U9, U10	A			16			8
74LS00	U11	B			14			7
MC4044	U12	B			14			7
74LS168	U14	A			16			8
MC12013	U15	A			16			8
MC12013	U16	A			16			8
74LS196	U17	B			14			7
8292	U19	B			14			7


DETAIL A
TOP VIEW
DETAIL B
TOP VIEW
DETAIL C
BOTTOM VIEW

HIGHEST REF DESIG	REF DESIG NOT USED
C74	C31
CR5	
E3	
L11	
Q7	
R78	R39, R43, R45
U19	U13, U18
VR1	

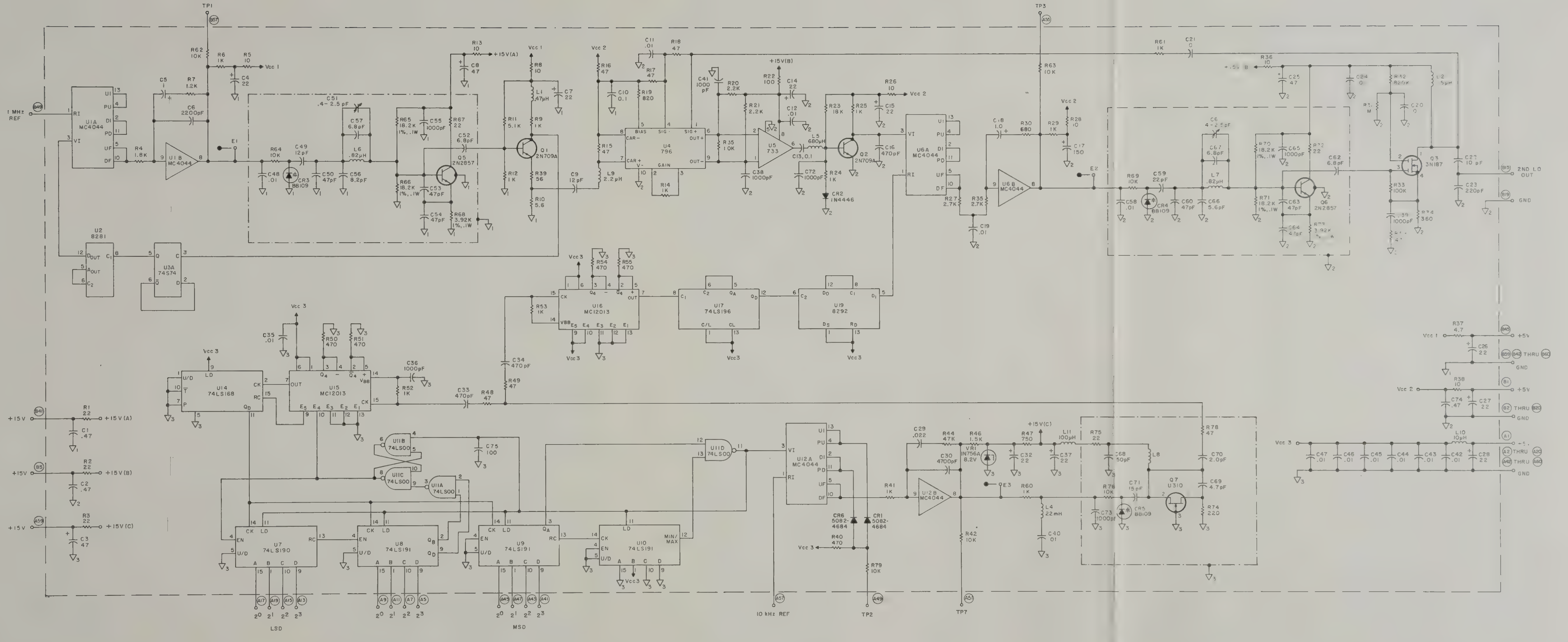

TP1
TP3
TP2
TP7
1 MHz REF
U1A MC4044
U1B MC4044
U2 8281
U3A 74S74
Q5 2N2857
Q1 2N709A
U4 796
U5 733
Q2 2N709A
U6A MC4044
U6B MC4044
Q6 2N2857
Q3 3N187
2ND LO OUT
GND
U16 MC12013
U17 74LS196
U19 8292
U14 74LS168
U15 MC12013
U11B 74LS00
U11C 74LS00
U11A 74LS00
U11D 74LS00
U12A MC4044
U12B MC4044
Q7 U310
U7 74LS190
U8 74LS191
U9 74LS191
U10 74LS191
LSD
MSD
10 kHz REF
+15V
+15V(A)
+15V(B)
+15V(C)
Vcc 1
Vcc 2
Vcc 3
+5V
E1
E2
E3

Figure 6-16. Type 791601 2nd LO Synthesizer (A5A2), Schematic Diagram 61256

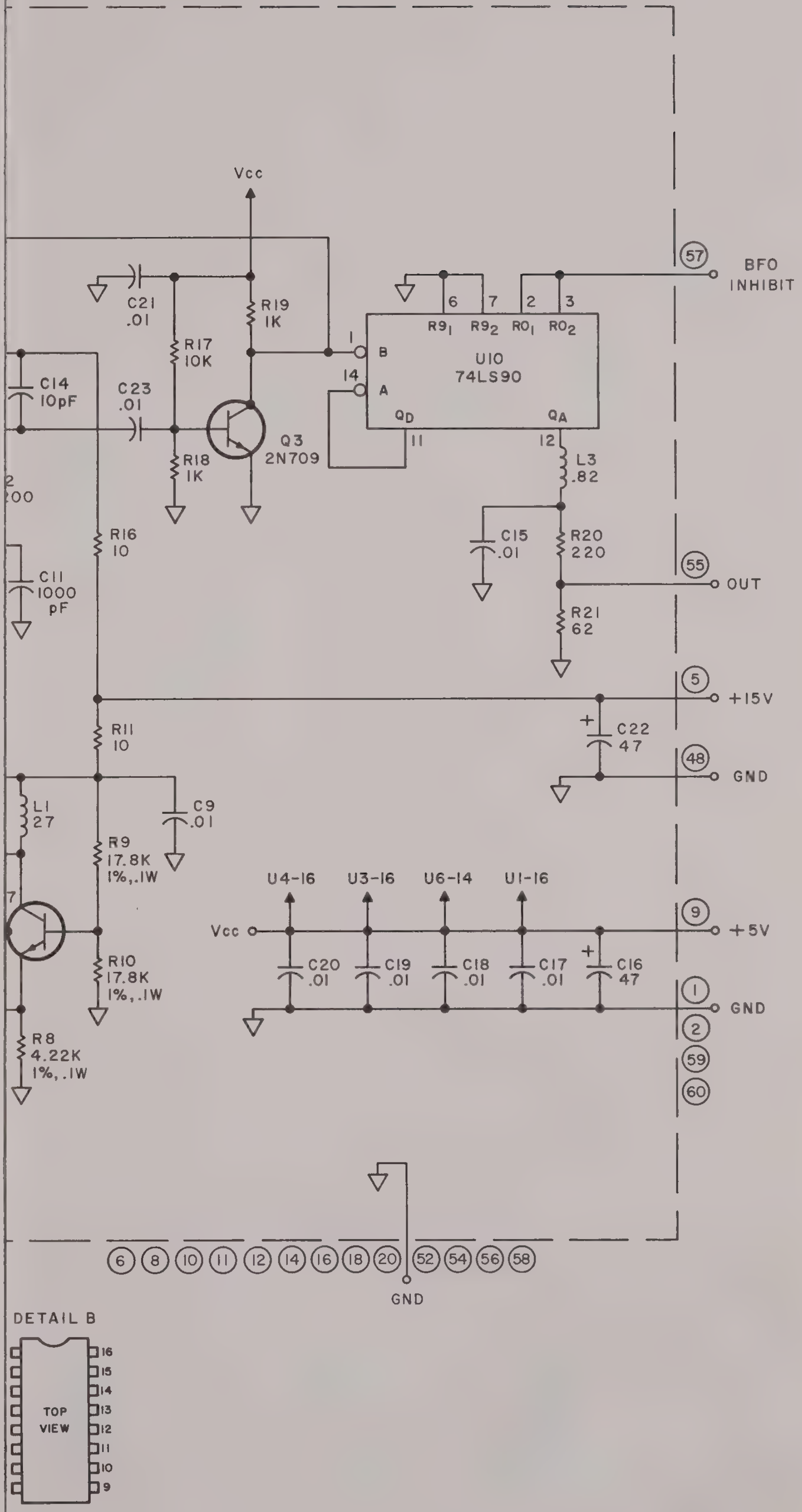
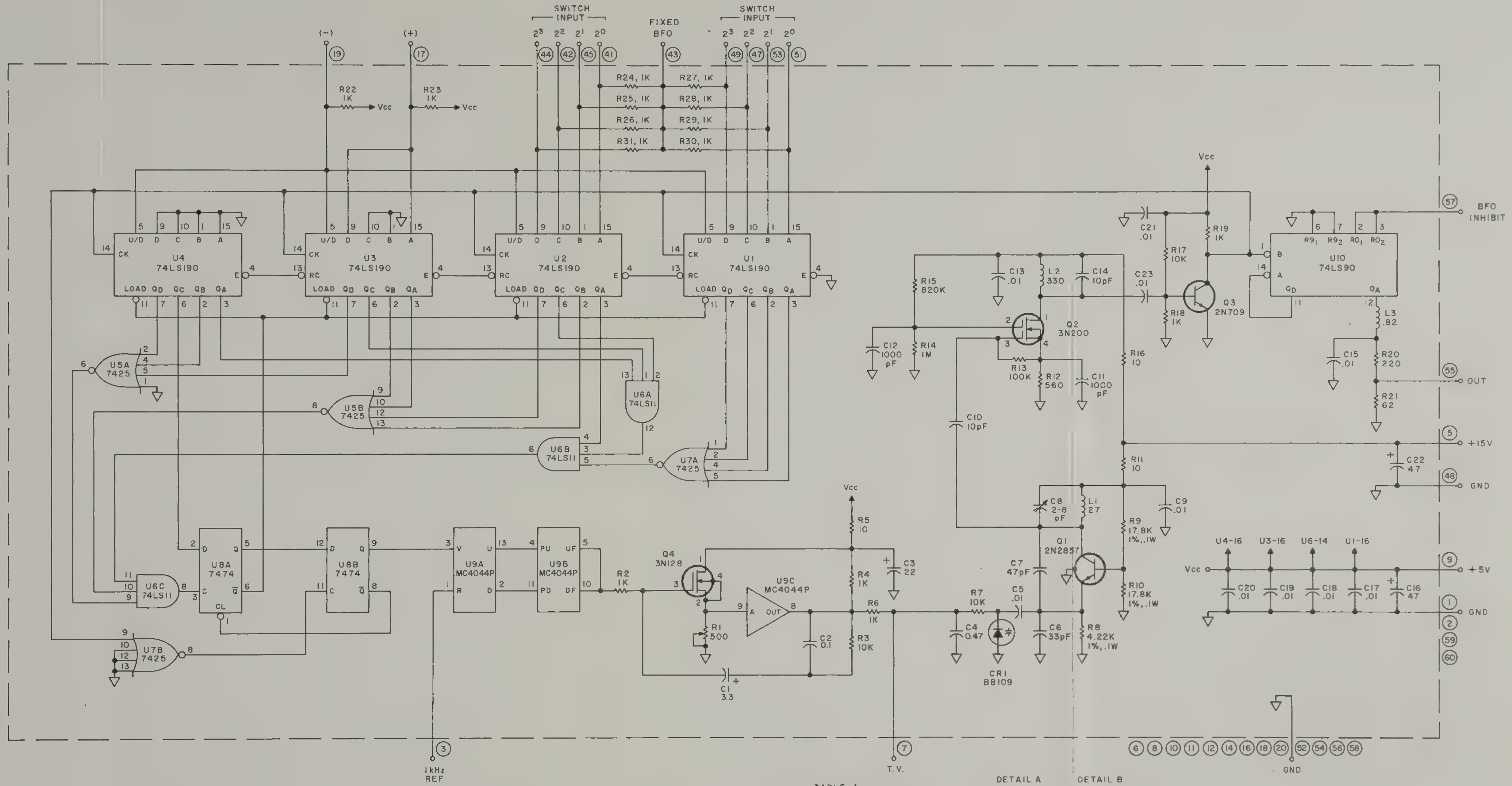

Vcc
57
BFO INHIBIT
C21 .01
R19 1K
R17 10K
6
7
2
3
R9₁ R9₂ RO₁ RO₂
1
B
14
A
U10 74LS90
QD
QA
11
12
C14 10pF
C23 .01
Q3 2N709
R18 1K
L3 .82
2
200
R16 10
C15 .01
R20 220
55
OUT
C11 1000 pF
R21 62
5
+15V
C22 47
48
GND
R11 10
L1 27
C9 .01
R9 17.8K 1%,.1W
U4-16
U3-16
U6-14
U1-16
7
Vcc
9
+5V
R10 17.8K 1%,.1W
C20 .01
C19 .01
C18 .01
C17 .01
C16 47
1
GND
2
59
60
R8 4.22K 1%,.1W
6 8 10 11 12 14 16 18 20 52 54 56 58
GND
DETAIL B
TOP VIEW
16
15
14
13
12
11
10
9

Figure 6-17. Type 791576 BFO Synthesizer (A5A3), Schematic Diagram 51183


SWITCH INPUT
FIXED BFO
(−)
(+)
2³ 2² 2¹ 2⁰
⑲ ⑰ ㊹ ㊷ ㊺ ㊶ ㊸ ㊾ ㊼ (53) (51)
R22 1K
R23 1K
Vcc
R24, 1K
R25, 1K
R26, 1K
R31, 1K
R27, 1K
R28, 1K
R29, 1K
R30, 1K
U4 74LS190
U3 74LS190
U2 74LS190
U1 74LS190
U/D D C B A
CK
RC
E
LOAD QD QC QB QA
U5A 7425
U5B 7425
U6A 74LS11
U6B 74LS11
U6C 74LS11
U7A 7425
U7B 7425
U8A 7474
U8B 7474
U9A MC4044P
U9B MC4044P
U9C MC4044P
PU UF PD DF
R2 1K
Q4 3N128
R1 500
C1 3.3
C2 0.1
R3 10K
R4 1K
R5 10
C3 22
R6 1K
R7 10K
C4 0.47
CR1 BB109
C5 .01
C6 33pF
C7 47pF
C8 2-8 pF
L1 27
Q1 2N2857
R8 4.22K 1%, .1W
R9 17.8K 1%, .1W
R10 17.8K 1%, .1W
R11 10
C9 .01
C10 10pF
C11 1000 pF
R12 560
R13 100K
R14 1M
C12 1000 pF
R15 820K
C13 .01
L2 330
C14 10pF
Q2 3N200
R16 10
C21 .01
C23 .01
R17 10K
R18 1K
R19 1K
Q3 2N709
U10 74LS90
R9₁ R9₂ R0₁ R0₂
L3 .82
C15 .01
R20 220
R21 62
C22 47
BFO INHIBIT
OUT
+15V
GND
+5V
U4-16 U3-16 U6-14 U1-16
C20 .01
C19 .01
C18 .01
C17 .01
C16 47
㊼ ⑤ ㊽ ⑨ ① ② (59) (60) (55) (57)
⑥ ⑧ ⑩ ⑪ ⑫ ⑭ ⑯ ⑱ ⑳ (52) (54) (56) (58)
1kHz REF
T.V.
GND

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
   c) INDUCTANCE IS IN μH.
2. ENCIRCLED NUMBERS ARE MODULE PINS.
3. U1 THRU U10 LEAD ARRANGEMENTS, Vcc/GND PINS ARE GIVEN IN TABLE A.

TABLE A

IC	REF DESIG	Vcc	GND	DTL
7425	U5, U7	14	7	A
7474	U8	14	7	A
74LS11	U6	14	7	A
74LS90	U10	5	10	A
74LS190	U1, U2, U3, U4	16	8	B
MC4044P	U9	14	7	A

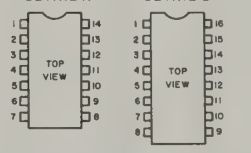

DETAIL A
DETAIL B
TOP VIEW
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Figure 6-17. Type 791576 BFO Synthesizer (A5A3), Schematic Diagram 51183

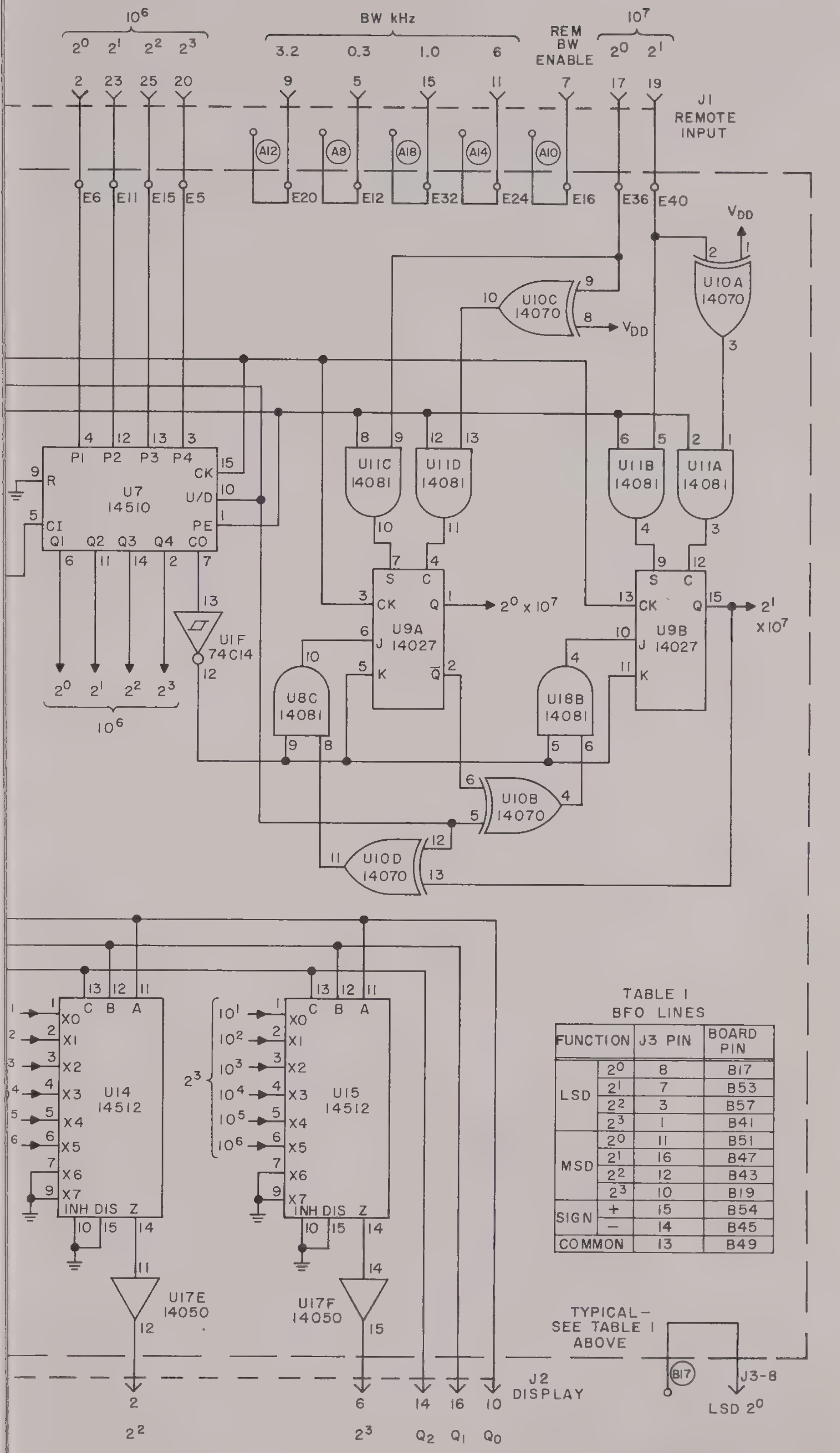

10⁶
2⁰ 2¹ 2² 2³
BW kHz
3.2 0.3 1.0 6
REM BW ENABLE
10⁷
J1 REMOTE INPUT
E6 E11 E15 E5 E20 E12 E32 E24 E16 E36 E40
A12 A8 A18 A14 A10
VDD
U10A 14070
U10C 14070
U7 14510
P1 P2 P3 P4 CK U/D PE CO R CI Q1 Q2 Q3 Q4
U1F 74C14
U11C 14081
U11D 14081
U11B 14081
U11A 14081
U9A 14027
U9B 14027
2⁰ x 10⁷
2¹ x10⁷
U8C 14081
U18B 14081
U10B 14070
U10D 14070
U14 14512
U15 14512
10¹ 10² 10³ 10⁴ 10⁵ 10⁶
X0 X1 X2 X3 X4 X5 X6 X7 INH DIS Z
U17E 14050
U17F 14050
J2 DISPLAY
2 6 14 16 10
2² 2³ Q2 Q1 Q0
TYPICAL– SEE TABLE I ABOVE
B17
J3-8
LSD 2⁰

TABLE I
BFO LINES

FUNCTION		J3 PIN	BOARD PIN
LSD	2^0	8	B17
	2^1	7	B53
	2^2	3	B57
	2^3	1	B41
MSD	2^0	11	B51
	2^1	16	B47
	2^2	12	B43
	2^3	10	B19
SIGN	+	15	B54
	–	14	B45
COMMON		13	B49

Type 791575 Manual Tuning Up/Down Counter (A6A1), Schematic Diagram 51180

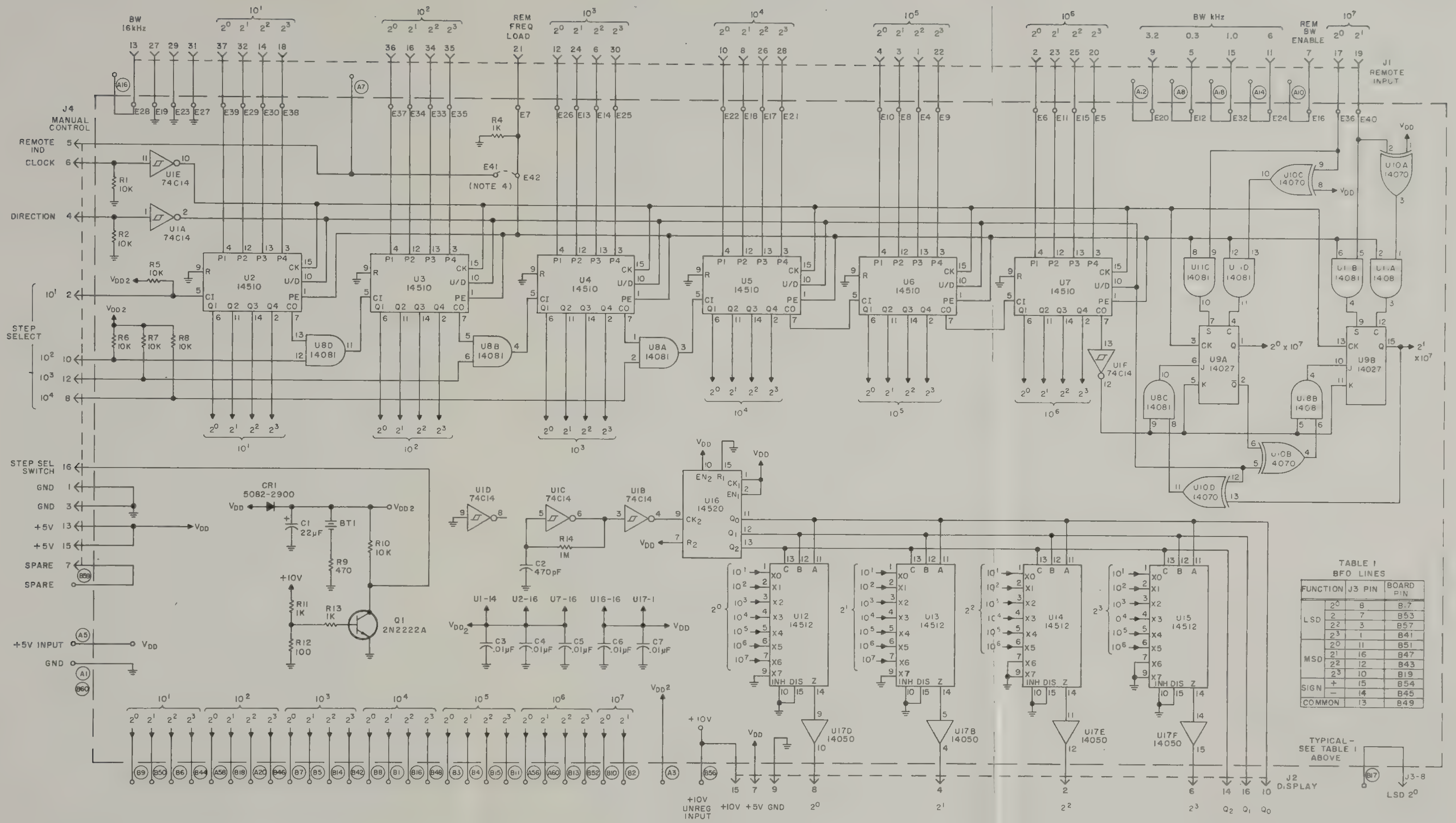

BW 16kHz
10¹
10²
REM FREQ LOAD
10³
10⁴
10⁵
10⁶
BW kHz
3.2
0.3
1.0
6
REM BW ENABLE
10⁷
J1 REMOTE INPUT
J4 MANUAL CONTROL
REMOTE IND
CLOCK
DIRECTION
STEP SELECT
STEP SEL SWITCH
GND
+5V
SPARE
+5V INPUT
U1E 74C14
U1A 74C14
R1 10K
R2 10K
R4 1K
R5 10K
R6 10K
R7 10K
R8 10K
E41
E42
(NOTE 4)
U2 14510
U3 14510
U4 14510
U5 14510
U6 14510
U7 14510
U8D 14081
U8B 14081
U8A 14081
U1F 74C14
U11C 14081
U11D 14081
U11B 14081
U11A 1408
U10C 14070
U10A 14070
U9A 14027
U9B 14027
U8C 14081
U18B 1408
U10B 4070
U10D 14070
2⁰ x 10⁷
2¹ x10⁷
CR1 5082-2900
C1 22μF
BT1
R9 470
R10 10K
+10V
R11 1K
R12 100
R13 1K
Q1 2N2222A
U1D 74C14
U1C 74C14
U1B 74C14
R14 1M
C2 470pF
U16 14520
U1-14
U2-16
U7-16
U16-16
U17-1
C3 .01μF
C4 .01μF
C5 .01μF
C6 .01μF
C7 .01μF
U12 14512
U13 14512
U14 14512
U15 14512
U17D 14050
U17B 14050
U17E 14050
U17F 14050
VDD
VDD2
+10V UNREG INPUT
+10V
+5V
GND
Q2
Q1
Q0
J2 DISPLAY
TYPICAL- SEE TABLE 1 ABOVE
J3-8
LSD 2⁰

TABLE 1
BFO LINES

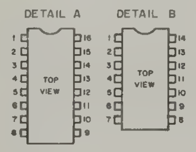
FUNCTION		J3 PIN	BOARD PIN
LSD	2^0	8	B17
	2	7	B53
	2^2	3	B57
	2^3	1	B41
MSD	2^0	11	B51
	2^1	16	B47
	2^2	12	B43
	2^3	10	B19
SIGN	+	15	B54
	−	14	B45
COMMON		13	B49

NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE IS IN OHMS, ±5%, 1/4W.
2. POWER CONNECTIONS AND PIN ARRANGEMENTS FOR ICs ARE GIVEN IN TABLE 2.
3. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
4. REMOVE JUMPER BETWEEN E42 AND E41 FOR EXTERNALLY ACTIVATED REMOTE CONTROL. THE PRESENSE OF THE JUMPER PROVIDES FRONT-PANEL ACTIVATED REMOTE CONTROL.
5. DIFFERENCE BETWEEN TYPES IS J1 REMOTE INPUT CABLE IS NOT USED ON DASH-1 VERSION

TABLE 2

IC	V_{DD} PIN	V_{DD} 2 PIN	GND PIN	DETAIL
U1, U8, U18		14	7	B
U2-U7, U9, U12-U15		16	8	A
U10, U11	14		7	B
U16	16		8	A
U17	1		8	A


DETAIL A
DETAIL B
TOP VIEW
TOP VIEW
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

HIGHEST REF DESIG	REF DESIG NOT USED
C7 CR1 E42 J4 Q1 R14 U18	R3

Figure 6-18. Type 791575 Manual Tuning Up/Down Counter (A6A1), Schematic Diagram 51180

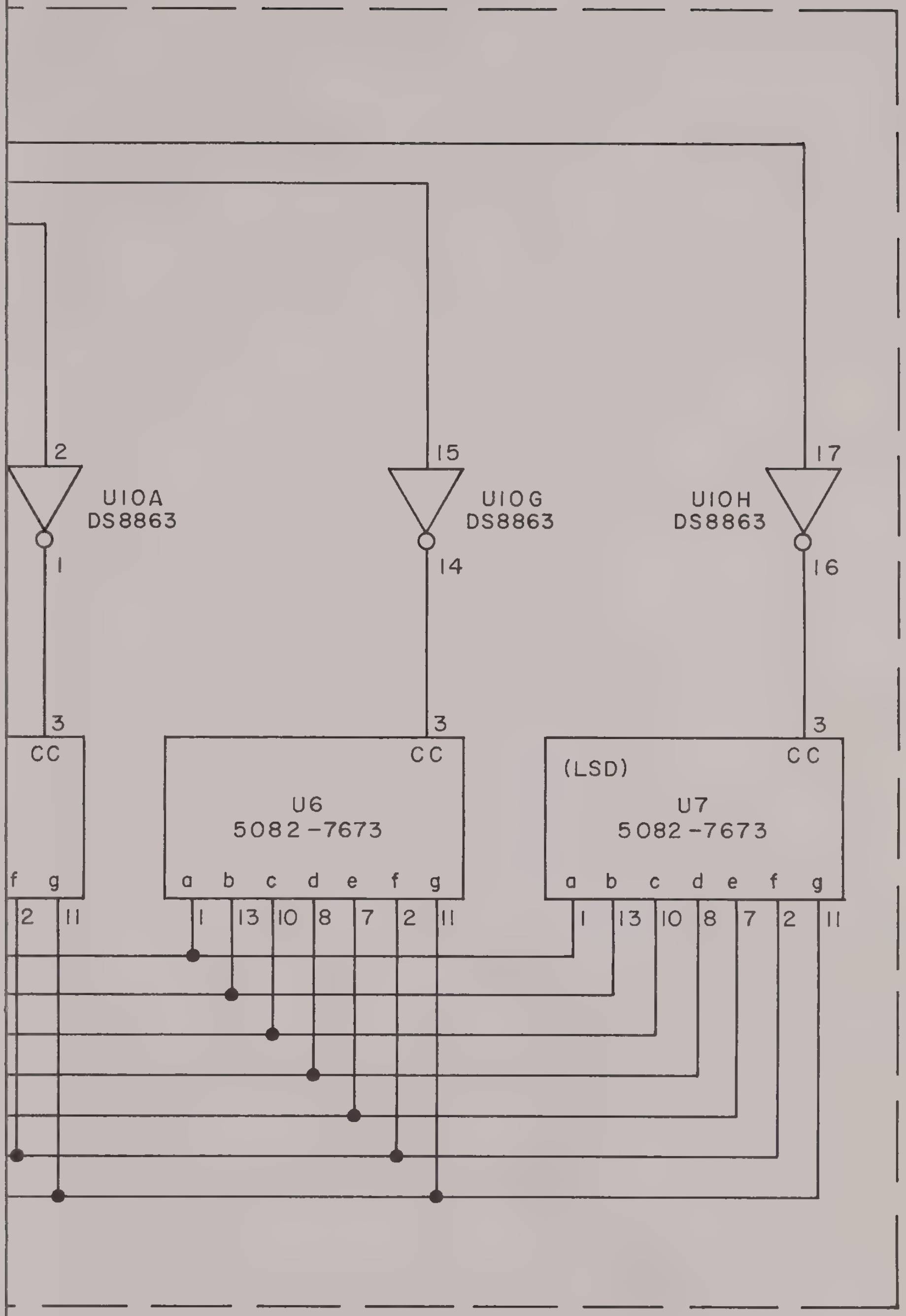
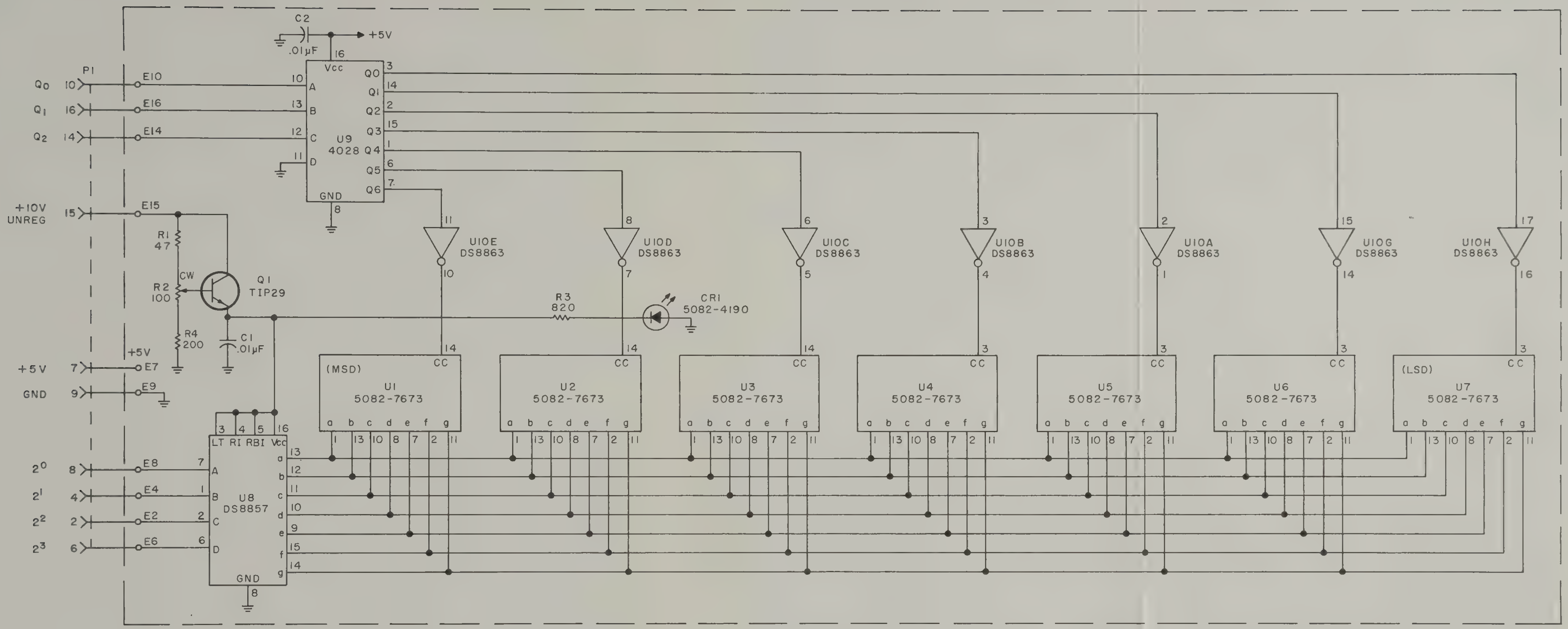

2
U10A
DS8863
1
15
U10G
DS8863
14
17
U10H
DS8863
16
3
CC
f g
2 11
3
CC
U6
5082-7673
a b c d e f g
1 13 10 8 7 2 11
3
(LSD)
CC
U7
5082-7673
a b c d e f g
1 13 10 8 7 2 11

Figure 6-19. Type 791578 Frequency Display (A8), Schematic Diagram 43242


Q0
Q1
Q2
+10V UNREG
+5V
GND
2^0
2^1
2^2
2^3
P1
E10
E16
E14
E15
E7
E9
E8
E4
E2
E6
C2 .01µF
+5V
U9 4028
Vcc
GND
R1 47
R2 100
CW
R4 200
Q1 TIP29
C1 .01µF
U8 DS8857
LT RI RBI Vcc
R3 820
CR1 5082-4190
U10E DS8863
U10D DS8863
U10C DS8863
U10B DS8863
U10A DS8863
U10G DS8863
U10H DS8863
(MSD) U1 5082-7673
U2 5082-7673
U3 5082-7673
U4 5082-7673
U5 5082-7673
U6 5082-7673
(LSD) U7 5082-7673
CC
a b c d e f g

NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE IS IN OHMS, ±5%, 1/4W.
2. U10 PIN 18 IS +5V; U10 PIN 9 IS GND.
3. PIN ARRANGEMENT FOR ICs IS SHOWN IN DETAILS A-C.

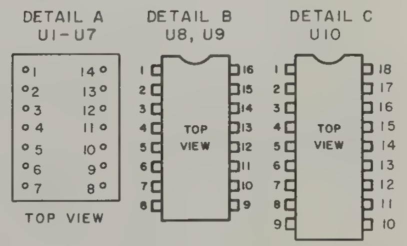

DETAIL A
U1-U7
TOP VIEW
DETAIL B
U8, U9
TOP VIEW
DETAIL C
U10
TOP VIEW

Figure 6-19. Type 791578 Frequency Display (A8), Schematic Diagram 43242

SECTION VII

SUPPLEMENT

7.1 GENERAL

The WJ-8716 HF Receiver is a modified version of the WJ-8718 HF Receiver. The modifications are to add the capability of EMI suppression. To accommodate this function, modifications have been made to the RF Filter, a Phone Jack Assembly and an Audio Attenuator has been added to the circuitry of the receiver, and four BNC connectors, filtered for EMI suppression, have been added to the back panel.

7.2 ELECTRICAL

7.2.1 The RF Filter Type 791616 (Ref. Desig. A2) has been modified to Type 796010. The schematic drawing for the RF Filter is Figure 7-1. An RF tuned network made up of C18 and L9 has been installed in the signal line between the RF input filter and the RF mixer. The network is tuned to 43.5 MHz and increases the insertion loss of the RF input between 43.5 MHz and 50 MHz.

7.2.2 The Phone Jack Assembly Type 796011 (Ref. Desig. A11) is new and pertains only to the WJ-8716 HF Receiver. The schematic drawing for the Phone Jack Assembly is Figure 7-2. The Phone Audio Output Jack is enclosed within an RF shielded housing. The audio signal entering the assembly is filtered by low pass filters. Silicon diodes in the network have been installed in a back-to-back configuration to limit the signal level at the Phones Jack to 1.2 volts.

7.2.3 The Audio Attenuator Type 280017 (Ref. Desig. A12) is new and pertains only to the WJ-8716 HF Receiver. The schematic drawing for the Audio Attenuator is Figure 7-3. A resistive network (power divider) provides isolation between the rear panel Phone Audio Output and the silicon diodes. Audio attenuation is provided for the Line Audio Output, Phone Audio Output, ISB Line Audio Output, and the FM Audio Output.

7.3 MECHANICAL

Four filtered BNC connectors are mounted on the rear panel. The Phone Audio Output, ISB Line Audio Output, Line Audio Output, and FM/CW/SSB Audio Output are the four new BNC connectors added to the back panel of the WJ-8716 HF Receiver.

7.4 REPLACEMENT PARTS LIST AND SCHEMATIC DIAGRAMS

The following list of manufacturers, parts lists, and schematic diagrams are a supplement for the WJ-8716 and are to be used in conjunction with Sections V and VI of this manual.

Mfr. Code	Name and Address
26342	Fiberglass of Ohio, Inc. Dayton, OH
80103	Lambda Electronics Corp. Div. of Veeco Instr., Inc. 515 Broad Hollow Road Melville, NY 11746

7.5 TYPE WJ-8716 HF RECEIVER MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, the WJ-8716 HF Receiver is identical electrically to the WJ-8718 HF Receiver.				
A2	RF Filter	1	796010	14632	
A11	Phone Jack Assembly	1	7916011	14632	
A12	Audio Attenuator	1	280017	14632	
C1	Capacitor, Ceramic, Disc: 0.1 μF, 20%, 50 V	4	34475-1	14632	
C5	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	2	34452-1	14632	
C6	Same as C5				
FL2	Filter, LP	4	52-713-301	33095	
FL3	Same as FL2				
FL4	Same as FL2				
FL5	Same as FL2				
FL1P1	Connector, Plug, Receptacle	9	2-350804-2	00779	
FL1P2	Same as P6				
FL1P3 Thru FL1P6	Same as FL1P1				
FL1P7	Same as P6				
J13	Not Used				
P6	Faston Receptacle	24	42236-1	00779	
P21	Same as P6				
P25	Same as FL1P1				
P26	Same as P6				
P27	Same as FL1P1				
P28	Same as P6				
P29	Same as P6				
P32	Same as P6				
P49	Same as FL1P1				
P50	Same as P6				
P51	Same as FL1P1				
R2	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
T1	Transformer	1	34507	14632	
T2	Not Used				
TB1	Not Used				
TB2	Not Used				
U1P1	Same as P6				

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U1P2	Same as P6				
U1P3	Same as P6				
U2P1	Same as P6				
U2P2	Same as P6				
U2P3	Same as P6				
U3P1	Same as P6				
U3P2	Same as P6				
U3P3	Same as P6				
W17	Cable Assembly	1	380005-1	14632	
W18	Cable Assembly	1	380005-21	14632	
W19	Cable Assembly	1	380005-2	14632	
W20	Cable Assembly	1	380005-19	14632	

7.5.1 TYPE 796010 RF FILTER REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 100 V	2	8131M100-651-474M	72982	
C2	Same as C1				
C3	Capacitor, Mica, Dipped: 20 pF, 5%, 500 V	1	CM05ED200J03	81349	72136
C4	Capacitor, Mica, Dipped: 68 pF, 2%, 500 V	1	CM05ED680G03	81349	72136
C5	Capacitor, Mica, Dipped: 10 pF±0.5 pF, 500 V	2	CM05CD100D03	81349	72136
C6	Capacitor, Mica, Dipped: 180 pF, 2%, 500 V	3	CM05FD181G03	81349	72136
C7	Same as C5				
C8	Same as C6				
C9	Capacitor, Mica, Dipped: 27 pF, 2%, 500 V	1	CM05ED270G03	81349	72136
C10	Same as C6				
C11	Capacitor, Mica, Dipped: 15 pF, 5%, 500 V	2	CM05CD150J03	81349	72136
C12	Capacitor, Mica, Dipped: 200 pF, 2%, 500 V	2	CM05FD201G03	81349	72136
C13	Capacitor, Mica, Dipped: 220 pF, 2%, 500 V	1	CM05FD221G03	81349	72136
C14	Same as C11				
C15	Same as C12				
C16	Capacitor, Mica, Dipped: 120 pF, 2%, 500 V	1	CM05FD121G03	81349	72136
C17	Capacitor, Mica, Dipped: 47 pF, 2%, 500 V	2	CM05ED470G03	81349	72136
C18	Same as C17				
CR1	Diode	2	1N4449	80131	93332
CR2	Same as CR1				
E1	Terminal, Forked	1	140-1941-02-01	71279	
J1	Connector, Receptacle	1	UG1094/U	80058	74868
L1	Coil, Torroidal	2	20681-186	14632	
L2	Coil, Torroidal	1	20681-187	14632	
L3	Same as L1				
L4	Coil, Torroidal	2	20681-188	14632	
L5	Coil, Torroidal	2	20681-189	14632	
L6	Same as L5				
L7	Same as L4				
L8	Inductor	1	21209-37	14632	
L9	Coil, Torroidal	1	20681-202	14632	
P1	Connector, Plug	1	UG1466/U	80058	19505
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	1	RCR07G103JS	81349	01121
VR1	Diode, Zener: 6.2 V	2	1N753A	80131	04713
VR2	Same as VR1				

7.5.2 Type 791598 ISB Detector/Audio REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 791598 ISB Detector/Audio is identical electrically to Type 791598 ISB Detector/Audio found in the WJ-8718 HF Receiver.				
R14	Resistor, Fixed, Composition: 47 kΩ, 5%, 1/4 W	4	RCR07G473JS	81349	01121
R56	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	2	RN55C1003F	81349	75042
R63	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R64	Same as R56				

7.5.2.1 Type 791599 FM, CW, & SSB Detector

REF DESIG PREFIX A4A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 791599 FM, CW, & SSB Detector is identical electrically to Type 791599 FM, CW, & SSB Detector found in the WJ-8718 HF Receiver.				
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 60 V	10	34452-1	14632	
C19	Capacitor, Electrolytic, Tantalum: 4.7 μF, 20%, 35 V	1	196D475X0035JE3	56289	

7.5.2.2 Type 7459 Audio Amplifier

REF DESIG PREFIX A4A10

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 7459 Audio Amplifier is identical electrically to Type 7459 Audio Amplifier found in the WJ-8718 HF Receiver.				
C18	Capacitor, Electrolytic, Tantalum: 47 µF, 10%, 35 V	3	CS13BF476K	81349	56289
C20	Same as C18				
CR4	Diode	1	1N4003	80131	04713
Q2	Transistor	1	TIP29	01295	
R25	Not Used				
R26	Not Used				

7.5.3 Type 34750 1st LO, VCO

REF DESIG PREFIX A5A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 34750 1st LO, VCO is identical electrically to Type 34750 1st LO, VCO found in the WJ-8718 HF Receiver.				
C6*	Capacitor, Ceramic, Tubular: 6 pF ±0.25 pF, 500 V	1	301-000C0H0-609C	72982	
R8	Resistor, Fixed, Composition: 300 Ω, 5%, 1/8 W	3	RCR05G301JS	81349	01121
R18	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/8 W	2	RCR05G102JS	81349	01121
R19	Same as R8				
R23	Resistor, Fixed, Composition: 10 Ω, 5%, 1/8 W	1	RCR05G100JS	81349	01121
R36	Same as R18				
R38	Not Used				
R39	Not Used				
T2	Transformer, Toroidal	2	21278-23	14632	
T4	Transformer, Toroidal	2	21278-27	14632	
T6	Same as T4				

*Nominal Value, Final Value Factory Selected

7.5.3.1 Type 791600 1st & 3rd LO Synthesizer REF DESIG PREFIX A5A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 791600 1st & 3rd LO Synthesizer is identical electrically to Type 791600 1st & 3rd LO Synthesizer found in the WJ-8718 HF Receiver.				
R64	Resistor, Fixed, Composition: 3.3 Ω, 5%, 1/4 W	1	RCR07G3R3JS	81349	01121
RA1	Heatsink	1	2225B	13103	
U15	Integrated Circuit	5	SN74LS196N	01295	

7.5.4 TYPE 791580 I/O MOTHER BOARD REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 791580 I/O Mother Board is identical electrically to Type 791580 I/O Mother Board found in the WJ-8718 HF Receiver.				
A1	Manual Tuning Up, Down Counter(customer option)	1	791575-1	14632	
A1	Manual Tuning Up, Down Counter(customer option)	1	791575-2	14632	
A1	Remote Control(customer option)	1	791577	14632	
A2	Front Panel Interconnect	1	791828	14632	

7.5.4.1 Type 791575-1 Manual Tuning Up/Down Counter REF DESIG PREFIX A6A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
BT1	Battery	1	1/3 AA-SD1	19209	
C1	Capacitor, Electrolytic, Tantalum: 22 μF, 10%, 15 V	1	CS13BD226K	81349	56289
C2	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	1	B470PFM	91418	
C3	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	5	34453-1	14632	
C4 Thru C7	Same as C3				
CR1	Diode	1	5082-2900	28480	
J1	Not Used				
J2	Connector Right Angle Header	3	87567-4	00779	
J3	Same as J2				
J4	Same as J2				
Q1	Transistor	1	2N2222A	80131	04713
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	7	RCR07G103JS	81349	01121
R2	Same as R1				
R3	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R4	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W	3	RCR07G102JS	81349	01121
R5 Thru R8	Same as R1				
R9	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	1	RCR07G471JS	81349	01121
R10	Same as R1				
R11	Same as R4				
R12	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R13	Same as R4				
R14	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W	1	RCR07G474JS	81349	01121
U1	Integrated Circuit	1	MM74C14N	27014	
U2	Integrated Circuit	6	MC14510P	04713	
U3 Thru U7	Same as U2				
U8	Integrated Circuit	3	MC14081P	04713	
U9	Integrated Circuit	1	MC14027P	04713	
U10	Integrated Circuit	1	MC14070P	04713	
U11	Same as U8				
U12	Integrated Circuit	4	MC14512P	04713	
U13	Same as U12				
U14	Same as U12				

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U15	Same as U12				
U16	Integrated Circuit	1	MC14520BCP	04713	
U17	Integrated Circuit	1	MC14050BP	04713	
U18	Same as U8				

7.5.4.2 Type 791575-2 Manual Tuning Up/Down Counter(customer option) REF DESIG PREFIX A6A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
BT1	Battery	1	1/3AA-SD1	19209	
C1	Capacitor, Electrolytic, Tantalum: 22 μF, 10%, 15 V	1	CS13BD226K	81349	56289
C2	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	1	B470PFM	91418	
C3	Capacitor, Ceramic, Disc: 0.01 μF, 20%, 50 V	5	34453-1	14632	
C4 Thru C7	Same as C3				
CR1	Diode	1	5082-2900	28480	
J1	Connector	1	88139-1	00779	
J2	Connector Right Angle Header	3	87567-4	00779	
J3	Same as J2				
J4	Same as J2				
Q1	Transistor	1	2N2222A	80131	04713
R1	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	7	RCR07G103JS	81349	01121
R2	Same as R1				
R3	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R4	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W	3	RCR07G102JS	81349	01121
R5 Thru R8	Same as R1				
R9	Resistor, Fixed, Composition: 470 Ω, 5%, 1/4 W	1	RCR07G471JS	81349	01121
R10	Same as R1				
R11	Same as R4				
R12	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R13	Same as R4				
R14	Resistor, Fixed, Composition: 470 kΩ, 5%, 1/4 W		RCR07G474JS	81349	01121
U1	Integrated Circuit	1	MM74C14N	27014	
U2	Integrated Circuit	6	MC14510P	04713	
U3 Thru U7	Same as U2				
U8	Integrated Circuit	3	MC14081P	04713	
U9	Integrated Circuit	1	MC14027P	04713	
U10	Integrated Circuit	1	MC14070P	04713	
U11	Same as U8				
U12	Integrated Circuit	4	MC14512P	04713	
U13 Thru U15	Same as U12				

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U16	Integrated Circuit	1	MC14520BCP	04713	
U17	Integrated Circuit	1	MC14050BP	04713	
U18	Same as U8				

7.5.4.3 Type 791577 Remote Control (customer option) REF DESIG PREFIX A6A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.01 MF, 20%, 50 V	3	34453-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	1	B470PFM		
J1	Connector, Receptacle, Multipin	1	609-37S	26342	
J2	Connector Right Angle Header	2	87567-4	00779	
J3	Same as J2				
P1	Connector	1	88139-1	00779	
R1	Resistor, Fixed, Composition: 1 MΩ, 5%, 1/4 W	2	RCR07G105JS	81349	01121
R2	Same as R1				
U1	Integrated Circuit	4	MC14174P	04713	
U2	Same as U1				
U3	Same as U1				
U4	Same as U1				
U5	Integrated Circuit	1	CD4013AE	02735	
U6	Integrated Circuit	4	MC14512P	04713	
U7	Same as U6				
U8	Same as U6				
U9	Same as U6				
U10	Integrated Circuit	1	MC14520BCP	04713	
U11	Integrated Circuit	1	MC14050BP	04713	
U12	Integrated Circuit	1	MM74C12N	27014	

7.5.4.4 Type 791828 Front Panel Interconnect REF DESIG PREFIX A6A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0.47 μF, 20%, 50 V	1	34452-1	14632	
CR1	Diode	10	1N995	80131	93332
CR2 Thru CR10	Same as CR1				
J1	Header	1	1-87567-6	00779	
Q1	Transistor	1	2N4037	80131	02735
R1	Resistor, Fixed, Composition: 1 kΩ, 5%, 1/4 W	1	RCR07G102JS	81349	01121
R2	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	1	RCR07G101JS	81349	01121
R3	Resistor, Fixed, Composition: 2.7 Ω, 5%, 1/4 W	1	RCR07G2R7JS	81349	01121
R4	Resistor, Fixed, Composition: 100 kΩ, 5%, 1/4 W	1	RCR07G104JS	81349	01121
R5	Resistor, Fixed, Composition: 22Ω, 5%, 1/2 W	1	RCR20G220JS	81349	01121
R6	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	2	RCR07G103JS	81349	01121
R7	Same as R6				
U1	Integrated Circuit	1	MC14053BP	04713	

7.5.5 TYPE 791827 BFO SWITCH

REF DESIG PREFIX A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	With the exception of those items listed below, Type 791827 BFO Switch is identical electrically to Type 791827 BFO Switch found in the WJ-8718 HF Receiver.				
S1	Switch	1	339910490-00226	09353	

7.5.6 TYPE 7916011 PHONE JACK ASSEMBLY REF DESIG PREFIX A11

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	Diode	4	1N4449	80131	93332
CR2	Same as CR1				
CR3	Same as CR1				
CR4	Same as CR1				
E1	Terminal	1	160-2380-01-05-00	71279	
FL1	Filter	2	51-353-314	33095	
FL2	Same as FL1				
J1	Connector, Phone Jack	1	L12B	82389	

7.5.7 TYPE 280017 AUDIO ATTENUATOR

REF DESIG PREFIX A12

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Electrolytic, Tantalum: 4.7 µF, 10%, 35 V	1	CS13BF475K	81349	56289
E1	Terminal	10	140-1941-02-01	71279	
E2 Thru E10	Same as E1				
R1	Resistor, Fixed, Composition: 750 Ω, 5%, 1/4 W	6	RCR07G751JS	81349	01121
R2	Resistor, Fixed, Composition: 2.7 kΩ, 5%, 1/4 W	3	RCR07G272JS	81349	01121
R3	Same as R1				
R4	Same as R1				
R5	Same as R2				
R6	Same as R1				
R7	Same as R1				
R8	Same as R2				
R9	Same as R1				
R10	Resistor, Fixed, Composition: 10 kΩ, 5%, 1/4 W	1	RCR07G103JS	81349	01121

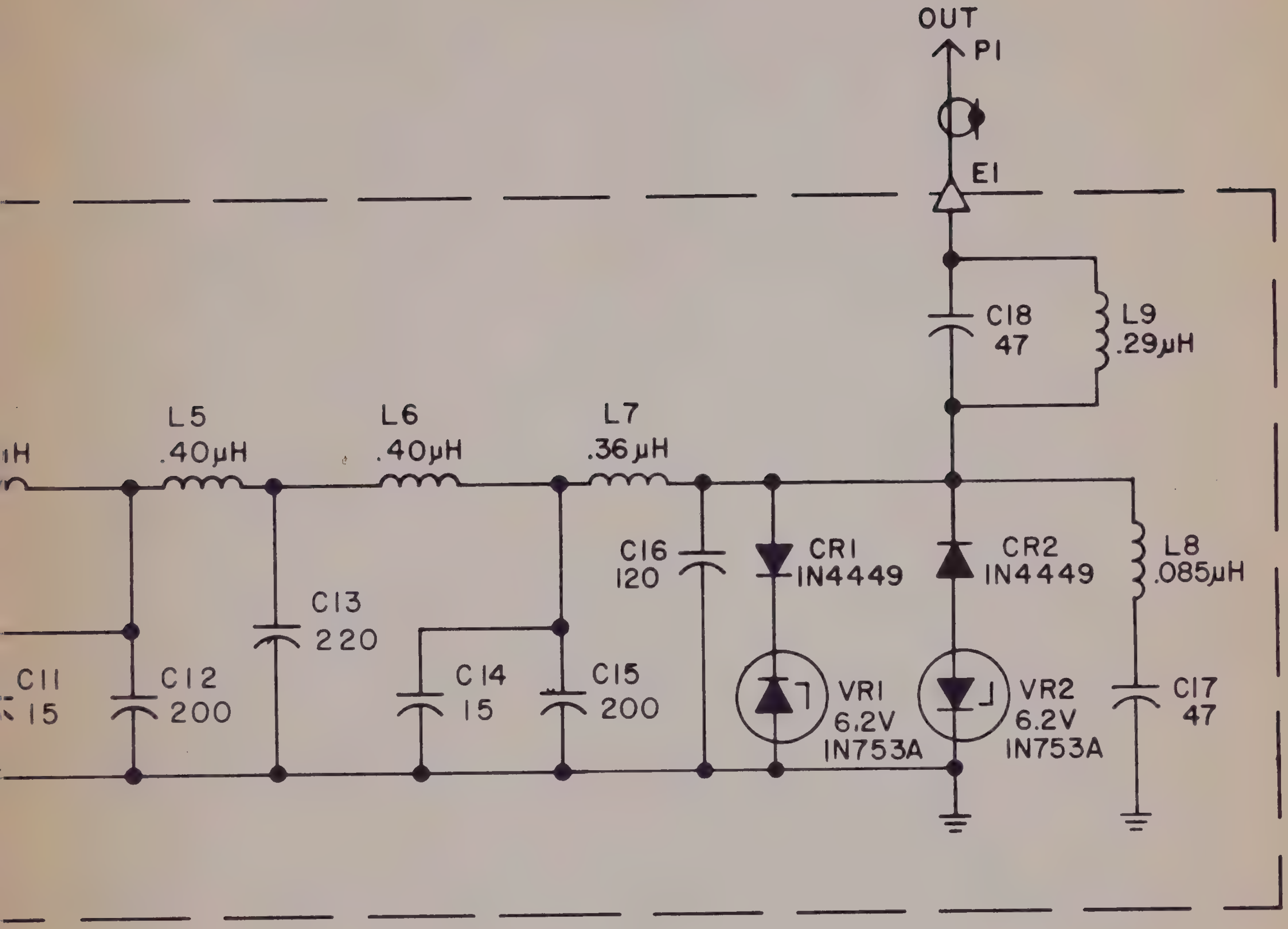
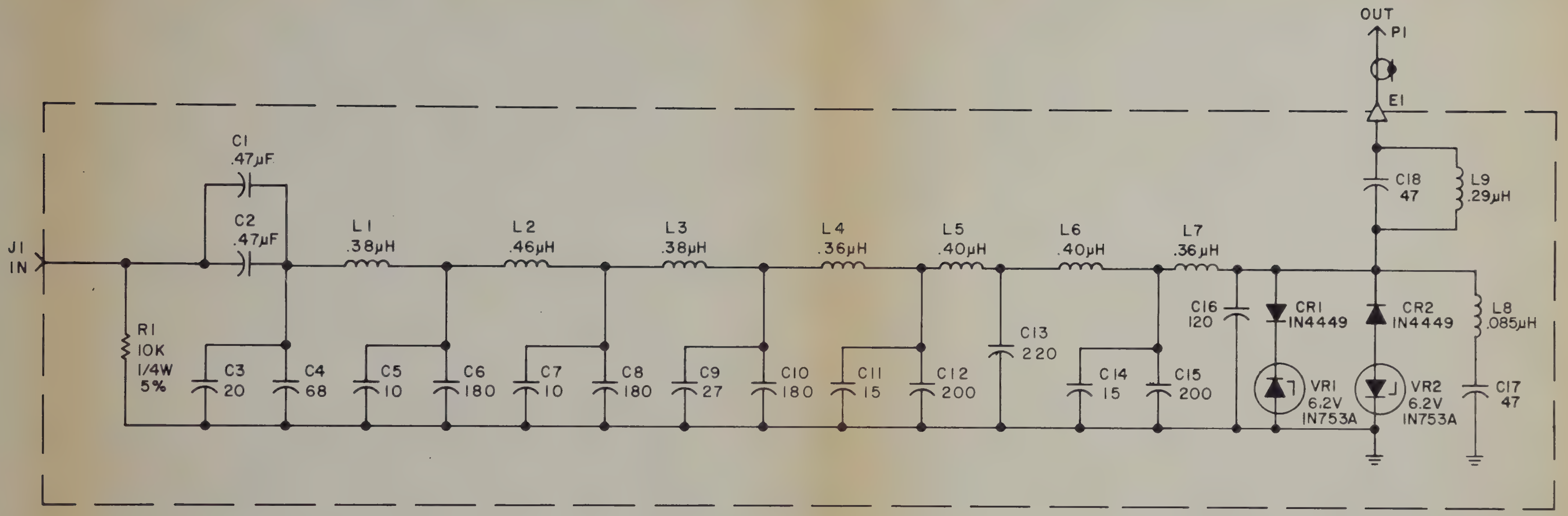

OUT
P1
E1
C18
47
L9
.29µH
L5
.40µH
L6
.40µH
L7
.36µH
C16
120
CR1
1N4449
CR2
1N4449
L8
.085µH
C13
220
C11
15
C12
200
C14
15
C15
200
VR1
6.2V
1N753A
VR2
6.2V
1N753A
C17
47

Figure 7-1. Type 796010 RF Filter (A2) Schematic Diagram 380001


OUT
P1
E1
J1
IN
C1
.47μF
C2
.47μF
R1
10K
1/4W
5%
C3
20
C4
68
L1
.38μH
C5
10
C6
180
L2
.46μH
C7
10
C8
180
L3
.38μH
C9
27
C10
180
L4
.36μH
C11
15
C12
200
L5
.40μH
C13
220
L6
.40μH
C14
15
C15
200
L7
.36μH
C16
120
CR1
1N4449
VR1
6.2V
1N753A
C18
47
L9
.29μH
CR2
1N4449
VR2
6.2V
1N753A
L8
.085μH
C17
47

NOTE: UNLESS SPECIFIED,
a) RESISTANCE IS IN OHMS.
b) CAPACITANCE IS pF

Figure 7-1. Type 796010 RF Filter (A2) Schematic Diagram 380001

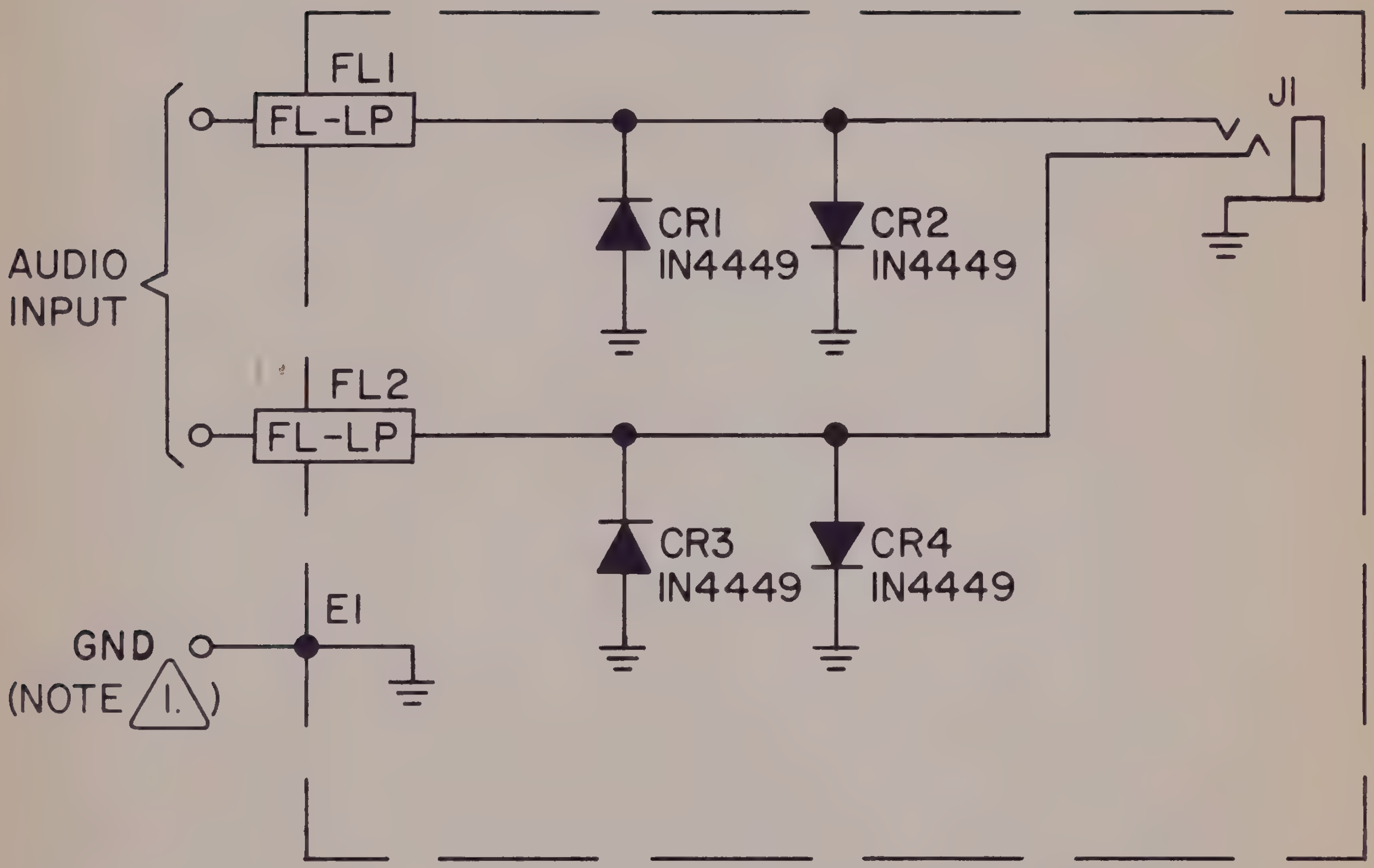

FL1
FL-LP
FL2
FL-LP
AUDIO INPUT
CR1
IN4449
CR2
IN4449
CR3
IN4449
CR4
IN4449
J1
E1
GND
(NOTE 1.)

Figure **7-2.** Type 796011 Phone Jack Assembly (A11)
Schematic Diagram 280018

NOTE:

1. DIFFERENCE BETWEEN TYPES IS:

TYPE NO	DIFFERENCE
796011-1	AS SHOWN
796011-2	OMIT EXTERNAL GND AT E1

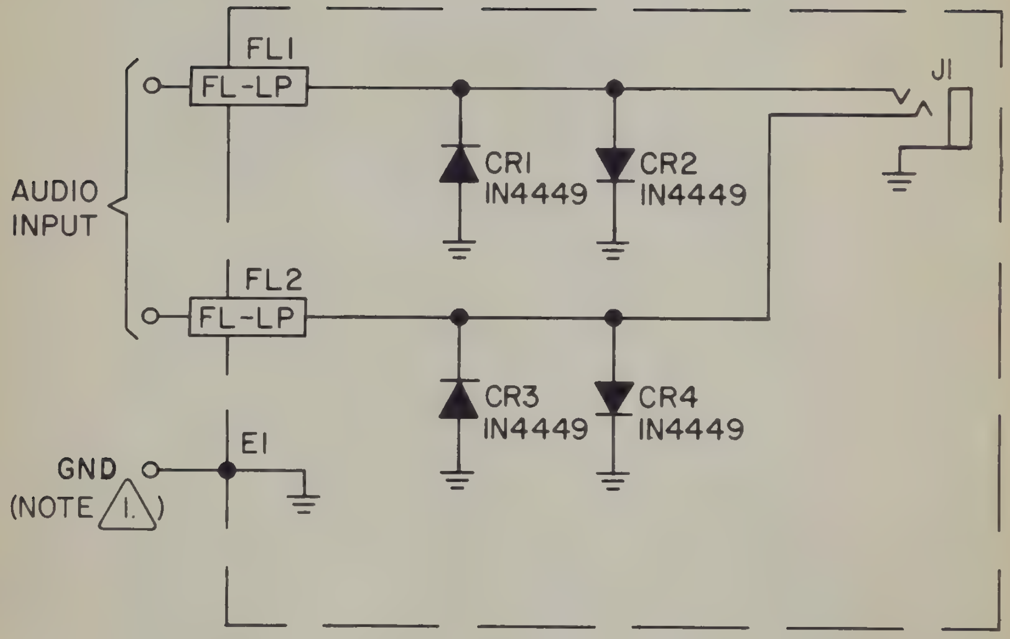
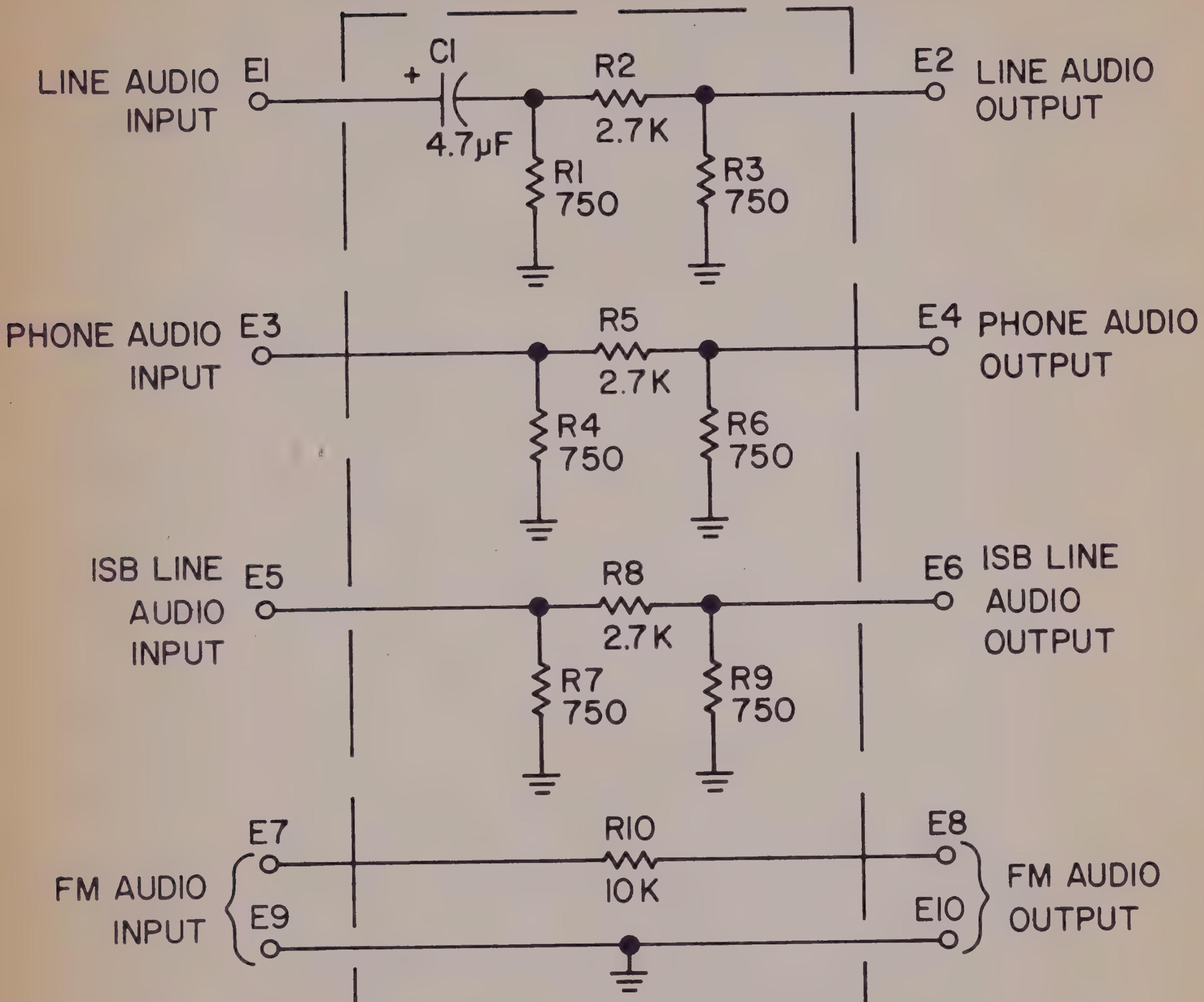

FL1
FL-LP
J1
AUDIO INPUT
CR1
1N4449
CR2
1N4449
FL2
FL-LP
CR3
1N4449
CR4
1N4449
E1
GND
(NOTE 1.)

Figure **7-2**. Type 796011 Phone Jack Assembly (A11) Schematic Diagram 280018


LINE AUDIO INPUT
E1
C1
+
4.7µF
R2
2.7K
R1
750
R3
750
E2
LINE AUDIO OUTPUT
PHONE AUDIO INPUT
E3
R5
2.7K
R4
750
R6
750
E4
PHONE AUDIO OUTPUT
ISB LINE AUDIO INPUT
E5
R8
2.7K
R7
750
R9
750
E6
ISB LINE AUDIO OUTPUT
FM AUDIO INPUT
E7
E9
R10
10K
E8
E10
FM AUDIO OUTPUT

RESISTANCE IS IN OHMS, ±5%, 1/4W.

Figure **7-3.** Type 280017 Audio Attenuator (A12) Schematic Diagram 280019

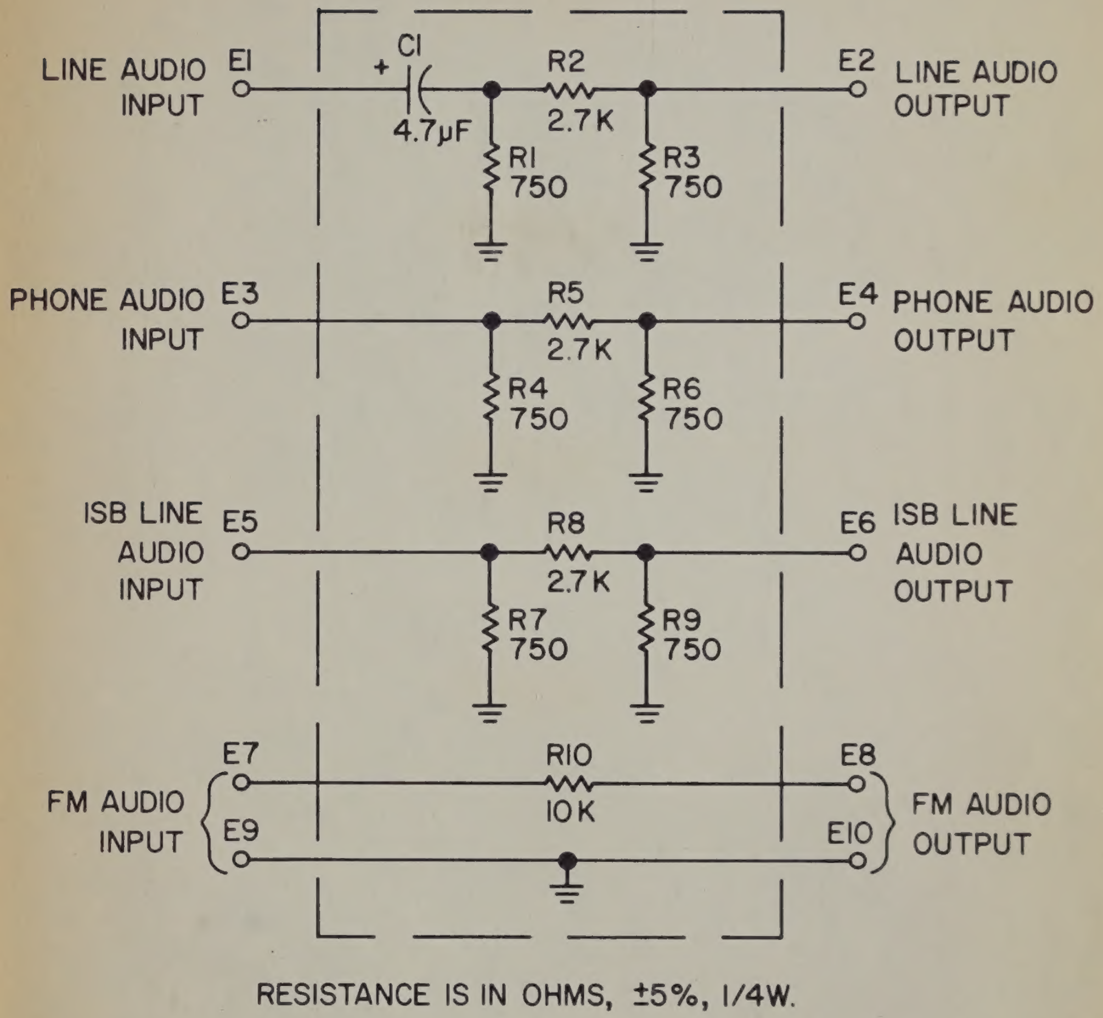

LINE AUDIO INPUT
E1
C1
+
4.7µF
R2
2.7K
R1
750
R3
750
E2
LINE AUDIO OUTPUT
PHONE AUDIO INPUT
E3
R5
2.7K
R4
750
R6
750
E4
PHONE AUDIO OUTPUT
ISB LINE AUDIO INPUT
E5
R8
2.7K
R7
750
R9
750
E6
ISB LINE AUDIO OUTPUT
E7
FM AUDIO INPUT
E9
R10
10K
E8
E10
FM AUDIO OUTPUT
RESISTANCE IS IN OHMS, ±5%, 1/4W.

Figure 7-3. Type 280017 Audio Attenuator (A12) Schematic Diagram 280019